LINKSYS®
A Division of Cisco Systems, Inc.

2.4GHz 802.11g

Wireless-G

ADSL Home Gateway

User Guide

WIRELESS

Model No. **WAG54G**

CISCO SYSTEMS

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How to Use this Guide

Your Guide to the Wireless-G ADSL Home Gateway has been designed to make understanding networking with the Gateway easier than ever. Look for the following items when reading this User Guide:

This checkmark means there is a Note of interest and is something you should pay special attention to while using the Gateway.

This exclamation point means there is a Caution or Warning and is something that could damage your property or the Gateway.

This question mark provides you with a reminder about something you might need to do while using the Gateway.

In addition to these symbols, there are definitions for technical terms that are presented like this:

word: *definition.*

Also, each figure (diagram, screenshot, or other image) is provided with a figure number and description, like this:

Figure 0-1: Sample Figure Description

Figure numbers and descriptions can also be found in the “List of Figures” section in the table of contents.

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Chapter 1: Introduction

Welcome

Thank you for choosing the Wireless-G ADSL Home Gateway. This Gateway will provide your computers with a high-speed Internet connection as well as resources, including files and printers. Since the Gateway is wireless, Internet access can be shared over the wired network as well as the wireless broadcast at up to 11Mbps for Wireless-B or up to 54Mbps for Wireless-G.

How does the Gateway do all of this? By connecting the Internet, as well as your computers and peripherals, to the Gateway, then the Gateway can direct and control communications for your network.

To protect your data and privacy, the Gateway features an advanced firewall to keep out Internet intruders. Wireless transmissions can be protected by powerful data encryption. In addition, you can safeguard your family with parental control features such as Internet access restrictions and keyword blocking. You can configure the Gateway's settings through the easy-to-use, browser-based utility.

But what does all of this mean?

Networks are useful tools for sharing Internet access and computer resources. You can access one printer from different computers and access data located on another computer's hard drive. Networks are even used for playing multiplayer video games. So, networks not only are useful in homes and offices, but also can be fun.

PCs on a wired network create a LAN, or Local Area Network. They are connected with Ethernet cables, which is why the network is called "wired." PCs equipped with wireless cards or adapters can communicate without cumbersome cables. By sharing the same wireless settings, within their transmission radius, they form a wireless network. This is sometimes called a WLAN, or Wireless Local Area Network. Since the Gateway has wireless capabilities, it can bridge your wired and wireless networks, letting them communicate with each other.

With your networks all connected, wired, wireless, and the Internet, you can now share files and Internet access—and even play games. All the while, the Wireless-G ADSL Home Gateway protects your networks from unauthorized and unwelcome users.

Linksys recommends using the Setup CD-ROM for first-time installation of the Gateway. If you do not wish to run the Setup Wizard on the Setup CD-ROM, then use the instructions in this Guide to help you connect the Gateway, set it up, and configure it to bridge your different networks. These instructions should be all you need to get the most out of the Wireless-G ADSL Home Gateway.

wpa *(wi-fi protected access): a wireless security protocol using TKIP (Temporal Key Integrity Protocol) encryption, which can be used in conjunction with a RADIUS server.*

spi *(stateful packet inspection)* ***firewall****: a technology that inspects incoming packets of information before allowing them to enter the network.*

firewall*: Security measures that protect the resources of a local network from intruders.*

nat *(network address translation): NAT technology translates IP addresses of a local area network to a different IP address for the Internet.*

network*: a series of computers or devices connected for the purpose of data sharing, storage, and/or transmission between users*

lan *(local area network): The computers and networking products that make up the network in your home or office.*

What's in this User Guide?

This user guide covers the steps for setting up and using the Wireless-G ADSL Home Gateway.

- Chapter 1: Introduction
  This chapter describes applications of the Wireless-G ADSL Home Gateway and this User Guide.

- Chapter 2: Planning Your Network
  This chapter describes the basics of networking.

- Chapter 3: Getting to Know the Wireless-G ADSL Home Gateway
  This chapter describes the physical features of the Gateway.

- Chapter 4: Connecting the Wireless-G ADSL Home Gateway
  This chapter instructs you on how to connect the Gateway to your network.

- Chapter 5: Configuring the Wireless-G ADSL Home Gateway
  This chapter explains how to use the Web-based Utility to configure the settings on the Gateway.

- Appendix A: Troubleshooting
  This appendix describes some problems and solutions, as well as frequently asked questions, regarding installation and use of the Wireless-G ADSL Home Gateway.

- Appendix B: Wireless Security
  This appendix explains the risks of wireless networking and some solutions to reduce the risks.

- Appendix C: Finding the MAC Address and IP Address for your Ethernet Adapter.
  This appendix describes how to find the MAC address for your computer's Ethernet adapter so you can use the MAC filtering and/or MAC address cloning feature of the Gateway.

- Appendix D: Upgrading Firmware
  This appendix instructs you on how to upgrade the firmware on the Gateway if you should need to do so.

- Appendix E: Glossary
  This appendix gives a brief glossary of terms frequently used in networking.

- Appendix F: Specifications
  This appendix provides the technical specifications for the Gateway.

- Appendix G: Warranty Information
  This appendix supplies the warranty information for the Gateway.

- Appendix H: Regulatory Information
  This appendix supplies the regulatory information regarding the Gateway.

- Appendix I: Contact Information
  This appendix provides contact information for a variety of Linksys resources, including Technical Support.

Chapter 2: Planning Your Network

The Gateway's Functions

A Gateway is a network device that connects two networks together.

In this instance, the Gateway connects your Local Area Network (LAN), or the group of computers in your home or office, to the Internet. The Gateway processes and regulates the data that travels between these two networks.

The Gateway's NAT feature protects your network of computers so users on the public, Internet side cannot "see" your computers. This is how your network remains private. The Gateway protects your network by inspecting every packet coming in through the Internet port before delivery to the appropriate computer on your network. The Gateway inspects Internet port services like the web server, ftp server, or other Internet applications, and, if allowed, it will forward the packet to the appropriate computer on the LAN side.

Remember that the Gateway's ports connect to two sides. The LAN ports connect to the LAN, and the ADSL port connects to the Internet. The LAN ports transmit data at 10/100Mbps.

IP Addresses

What's an IP Address?

IP stands for Internet Protocol. Every device on an IP-based network, including computers, print servers, and Gateways, requires an IP address to identify its "location," or address, on the network. This applies to both the Internet and LAN connections. There are two ways of assigning an IP address to your network devices. You can assign static IP addresses or use the Gateway to assign IP addresses dynamically.

Static IP Addresses

A static IP address is a fixed IP address that you assign manually to a computer or other device on the network. Since a static IP address remains valid until you disable it, static IP addressing ensures that the device assigned it will always have that same IP address until you change it. Static IP addresses must be unique and are commonly used with network devices such as server computers or print servers.

Figure 2-1: Network

***ip** (internet protocol): a protocol used to send data over a network*

NOTE: Since the Gateway is a device that connects two networks, it needs two IP addresses—one for the LAN, and one for the Internet. In this User Guide, you'll see references to the "Internet IP address" and the "LAN IP address."

Since the Gateway uses NAT technology, the only IP address that can be seen from the Internet for your network is the Gateway's Internet IP address. However, even this Internet IP address can be blocked, so that the Gateway and network seem invisible to the Internet—see the Block WAN Requests description under Security in "Chapter 5: Configuring the Wireless-G ADSL Home Gateway."

Since you use the Gateway to share your DSL Internet connection, contact your ISP to find out if they have assigned a static IP address to your account. If so, you will need that static IP address when configuring the Gateway. You can get that information from your ISP.

Dynamic IP Addresses

A dynamic IP address is automatically assigned to a device on the network, such as computers and print servers. These IP addresses are called "dynamic" because they are only temporarily assigned to the computer or device. After a certain time period, they expire and may change. If a computer logs onto the network (or the Internet) and its dynamic IP address has expired, the DHCP server will automatically assign it a new dynamic IP address.

DHCP (Dynamic Host Configuration Protocol) Servers

Computers and other network devices using dynamic IP addressing are assigned a new IP address by a DHCP server. The computer or network device obtaining an IP address is called the DHCP client. DHCP frees you from having to assign IP addresses manually every time a new user is added to your network.

A DHCP server can either be a designated computer on the network or another network device, such as the Gateway. By default, the Gateway's DHCP Server function is enabled.

If you already have a DHCP server running on your network, you must disable one of the two DHCP servers. If you run more than one DHCP server on your network, you will experience network errors, such as conflicting IP addresses. To disable DHCP on the Gateway, see the DHCP section in "Chapter 5: Configuring the Wireless-G ADSL Home Gateway."

What is a VPN?

A VPN, or Virtual Private Network, is a connection between two endpoints — a VPN Gateway, for instance — in different networks that allows private data to be sent securely over a shared or public network such as the Internet. This establishes a private network that can send data securely between these two locations or networks.

This is done by creating a "tunnel." A VPN tunnel connects the two computers or networks and allows data to be transmitted over the Internet as if it were still within those networks. Not a literal tunnel, it is a connection secured by encrypting the data sent between the two networks.

VPNs were created as a cost-effective alternative to using a private, dedicated, leased line for a private network. Using industry-standard encryption and authentication techniques — IPSec, short for IP Security — the VPN creates a secure connection that, in effect, operates as if you were directly connected to your local network. Virtual Private Networking can be used to create secure networks linking a central office with branch offices,

telecommuters, and/or professionals on the road (travelers can connect to a VPN Gateway using any computer with VPN client software that supports IPSec, such as SSH Sentinel.)

There are two basic ways to create a VPN connection:

- VPN Gateway to VPN Gateway
- Computer (using VPN client software that supports IPSec) to VPN Gateway

The VPN Gateway creates a "tunnel" or channel between two endpoints, so that data transmissions between them are secure. A computer with VPN client software that supports IPSec can be one of the two endpoints. Any computer with the built-in IPSec Security Manager (Microsoft 2000 and XP) allows the VPN Gateway to create a VPN tunnel using IPSec. Other versions of Microsoft operating systems require additional, third-party VPN client software applications that support IPSec to be installed.

Computer (using VPN client software that supports IPSec) to VPN Gateway

The following is an example of a computer-to-VPN Gateway VPN: In her hotel room, a traveling businesswoman dials up her ISP. Her notebook computer has VPN client software that is configured with her office's VPN settings. She accesses the VPN client software that supports IPSec and connects to the VPN Gateway at the central office. As VPNs utilize the Internet, distance is not a factor. Using the VPN, the businesswoman now has a secure connection to the central office's network, as if she were physically connected.

VPN Gateway to VPN Gateway

An example of a VPN Gateway-to-VPN Gateway VPN would be as follows: At home, a telecommuter uses his VPN Gateway for his always-on Internet connection. His Gateway is configured with his office's VPN settings. When he connects to his office's Gateway, the two Gateways create a VPN tunnel, encrypting and decrypting data. As VPNs utilize the Internet, distance is not a factor. Using the VPN, the telecommuter now has a secure connection to the central office's network, as if he were physically connected.

For additional information and instructions about creating your own VPN, please visit Linksys's international Web site at http://www.linksys.com/international/.

Why do I need a VPN?

Computer networking provides a flexibility not available when using a paper-based system. With this flexibility, however, comes an increased risk in security. This is why firewalls were first introduced. Firewalls help to protect data inside of a local network. But what do you do once information is sent outside of your local network, when

e-mails are sent to their destination, or when you have to connect to your company's network when you are out on the road? How is your data protected?

That is when a VPN can help. VPNs secure data moving outside of your network as if it were still within that network.

When data is sent out across the Internet from your computer, it is always open to attacks. You may already have a firewall, which will help protect data moving around or held within your network from being corrupted or intercepted by entities outside of your network, but once data moves outside of your network — when you send data to someone via email or communicate with an individual over the Internet — the firewall will no longer protect that data.

At this point, your data becomes open to hackers using a variety of methods to steal not only the data you are transmitting but also your network login and security data. Some of the most common methods are as follows:

1) MAC Address Spoofing

Packets transmitted over a network, either your local network or the Internet, are preceded by a packet header. These packet headers contain both the source and destination information for that packet to transmit efficiently. A hacker can use this information to spoof (or fake) a MAC address allowed on the network. With this spoofed MAC address, the hacker can also intercept information meant for another user.

2) Data Sniffing

Data “sniffing” is a method used by hackers to obtain network data as it travels through unsecured networks, such as the Internet. Tools for just this kind of activity, such as protocol analyzers and network diagnostic tools, are often built into operating systems and allow the data to be viewed in clear text.

3) Man in the Middle Attacks

Once the hacker has either sniffed or spoofed enough information, he can perform a “man in the middle” attack. This attack is performed, when data is being transmitted from one network to another, by rerouting the data to a new destination. Even though the data is not received by its intended recipient, it appears that way to the person sending the data.

These are only a few of the methods hackers use and they are always developing more. Without the security of your VPN, your data is constantly open to such attacks as it travels over the Internet. Data travelling over the Internet will often pass through many different servers around the world before reaching its final destination. That's a long way to go for unsecured data and this is when a VPN serves its purpose.

Chapter 3: Getting to Know the Wireless-G ADSL Home Gateway

Ports and Reset Button on Side Panel

The Gateway's ports and Reset button are located on a side panel.

Figure 3-1: Ports and Reset Button on Side Panel

Line The **Line** port connects to the ADSL line.

Ethernet (1-4) The **Ethernet** ports connect to your computers and other network devices.

Reset Button There are two ways to reset the Gateway's factory defaults. Either press the **Reset Button**, for approximately ten seconds, or restore the defaults from the *Factory Defaults* screen of the Administration tab in the Gateway's Web-based Utility.

Power The **Power** port is where you will connect the power adapter.

IMPORTANT: Resetting the Gateway to factory defaults will erase all of your settings (including Internet connection, wireless, and other settings) and replace them with the factory defaults. Do not reset the Gateway if you want to retain these settings.

LEDs and Power Button on Side Panel

The Gateway's LEDs, which indicate network activity, are located on the other side panel. The Gateway's power button is also located on this panel.

Figure 3-2: Power Button and LEDs on Side Panel

Press the power button to turn the Gateway on or off when power is available from the power adapter.

The Gateway's LEDs are described below.

POWER Green. The **POWER** LED lights up when the Gateway is powered on.

WIRELESS Green. The **WIRELESS** LED lights up whenever there is a successful wireless connection. If the LED is flashing, the Gateway is actively sending or receiving data to or from one of the devices on the network.

ETHERNET (1-4) Green. The **ETHERNET** LED serves two purposes. If the LED is continuously lit, the Gateway is successfully connected to a device through the LAN port. If the LED is flashing, it is an indication of any network activity.

DSL Green. The **DSL** LED lights up whenever there is a successful DSL connection. The LED blinks while the Gateway is establishing the ADSL connection.

INTERNET Green/Red. The **INTERNET** LED lights up green when a connection to your Internet Service Provider (ISP) is established, and blinks when information is passing through the connection. If the connection is in bridge-only mode, however, the **INTERNET** LED does not light up. The **INTERNET** LED lights up red when the connection to the ISP fails.

The Top Panel

The Gateway comes with a detachable external antenna. The SMA-type connector for the antenna is located on the top panel. To attach the antenna, slip its lower end onto the SMA connector and turn its knurled base clockwise until it is firmly seated. The antenna can swivel on its base and has a hinge with stops for orientation at four different angles.

Figure 3-3: Top Panel

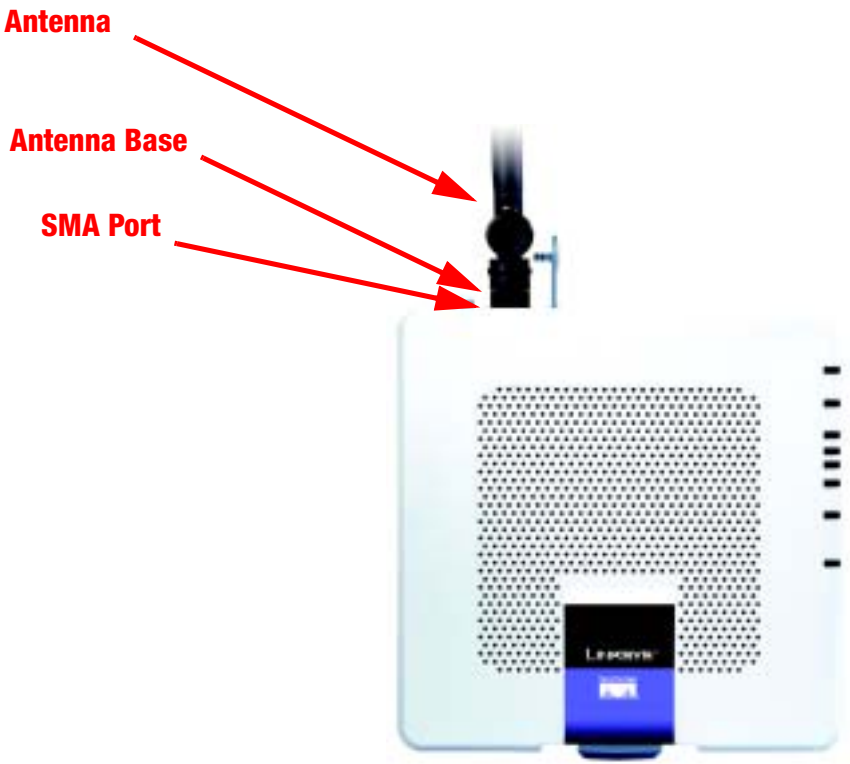

Figure 3-4: Top Panel with Antenna

The Bottom Panel

The Gateway has a built-in stand available. If you place the Gateway flat on a surface, then you can leave the stand in the closed position. However, if you want the Gateway to be upright, swivel the stand clockwise 90º and position the Gateway accordingly.

Figure 3-5: Bottom Panel with Stand in Closed Position

Figure 3-6: Gateway Using Stand

Chapter 4: Connecting the Wireless-G ADSL Home Gateway

Overview

The installation technician from your ISP should have left the setup information for the modem with you after installing your broadband connection. If not, you can call your ISP to request that data.

After you have the setup information you need for your specific type of Internet connection, you can begin installation and setup of the Gateway.

If you want to use a computer with an Ethernet adapter to configure the Gateway, continue to "Wired Connection to a Computer." If you want to use a computer with a wireless adapter to configure the Gateway, continue to "Wireless Connection to a Computer."

Wired Connection to a Computer

1. Make sure that all of your network's hardware is powered off, including the Gateway and all computers.

2. Connect a phone cable from the Line port on the Gateway's side panel to the wall jack of the ADSL line. A small device called a microfilter (not included) may be necessary between each phone and wall jack to prevent interference. Contact your ISP if you have any questions.

NOTE: A small device called a microfilter (not included) may be necessary between each phone and wall jack to prevent interference. Contact your ISP if you have any questions.

IMPORTANT: For countries that have phone jacks with RJ-11 connectors, make sure to only place the microfilters between the phone and the wall jack and **not** between the Gateway and the wall jack or your ADSL will not connect.

For countries that do **not** have phone jacks with RJ-11 connectors (e.g. France, Sweden, Switzerland, United Kingdom, etc.), except for ISDN users, the microfilter has to be used between the Gateway and the wall jack, because the microfilter will have the RJ-11 connector.

Annex B users (E1 and DE versions of the Gateway) must use the included special cable to connect the Gateway to the wall jack (RJ-45 to RJ-12). If you require splitters or special jacks, please contact your service provider.

3. Connect one end of an Ethernet network cable to one of the Ethernet ports (labeled 1-4) on the back of the Gateway, and the other end to an Ethernet port on a computer. Repeat this step to connect more computers, a switch, or other network devices to the Gateway.

4. Connect the power adapter to the Gateway's Power port, plug the power adapter into a power outlet, and press the Gateway's power button.

NOTE: You should always plug the Gateway's power adapter into a power strip with surge protection.

The Power LED on the front panel will light up red as soon as the Gateway is turned on. The Power LED will next flash green for a few seconds, and then it will be solidly lit when the self-test is complete. If the LED flashes for one minute or longer, see "Appendix A: Troubleshooting."

5. Power on one of your computers that is connected to the Gateway.

Go to "Chapter 5: Configuring the Wireless-G ADSL Home Gateway."

Figure 4-1: Connect the ADSL Line

Figure 4-2: Connect a PC

Figure 4-3: Connect the Power

Wireless Connection to a Computer

If you want to use a wireless connection to access the Gateway, follow these instructions:

1. Make sure that all of your network's hardware is powered off, including the Gateway and all computers.
2. Connect a phone cable from the Line port on the Gateway's back panel to the wall jack of the ADSL line. A small device called a microfilter (not included) may be necessary between each phone and wall jack to prevent interference. Contact your ISP if you have any questions.

NOTE: A small device called a microfilter (not included) may be necessary between each phone and wall jack to prevent interference. Contact your ISP if you have any questions.

IMPORTANT: For countries that have phone jacks with RJ-11 connectors, make sure you only place the microfilters between the phone and the wall jack and **not** between the Gateway and the wall jack or your ADSL will not connect.

For countries that do **not** have phone jacks with RJ-11 connectors (e.g. France, Sweden, Switzerland, United Kingdom, etc.), except for ISDN users, the microfilter has to be used between the Gateway and the wall jack, because the microfilter will have the RJ-11 connector.

Annex B users (E1 and DE versions of the Gateway) must use the included special cable to connect the Gateway to the wall jack (RJ-45 to RJ-12). If you require splitters or special jacks, please contact your service provider.

3. Connect the power adapter to the Power port, plug the power adapter into a power outlet, and press the Gateway's power button.

   The Power LED on the front panel will light up red as soon as the Gateway is turned on. The Power LED will next flash green for a few seconds, and then it will be solidly lit when the self-test is complete. If the LED flashes for one minute or longer, see "Appendix A: Troubleshooting."

4. Power on one of the computers on your wireless network(s).
5. For initial access to the Gateway through a wireless connection, make sure the computer's wireless adapter has its SSID set to **linksys** (the Gateway's default setting), and its wireless security is disabled. After you have accessed the Gateway, you can change the Gateway and this computer's adapter settings to match your usual network settings.

Go to "Chapter 5: Configuring the Wireless-G ADSL Home Gateway."

Figure 4-4: Connect the ADSL Line

Figure 4-5: Connect the Power

NOTE: You should always change the SSID from its default, **linksys**, and enable wireless security.

Chapter 5: Configuring the Wireless-G ADSL Home Gateway

Overview

Follow the steps in this chapter and use the Gateway's Web-based utility to configure the Gateway. This chapter will describe each web page in the Utility and each page's key functions. The utility can be accessed via your Web browser through use of a computer connected to the Gateway. For a basic network setup, most users only have to use the following screens of the Utility:

- Basic Setup. On the Basic Setup screen, enter the settings provided by your ISP.
- Management. Click the **Administration** tab and then the **Management** tab. The Gateway's default username and password is admin. To secure the Gateway, change the Password from its default.

There are seven main tabs: Setup, Wireless, Security, Access Restriction, Applications & Gaming, Administration, and Status. Additional tabs will be available after you click one of the main tabs.

HAVE YOU: Enabled TCP/IP on your computers? Computers communicate over the network with this protocol. Refer to Windows Help for more information on TCP/IP.

NOTE: For added security, you should change the password through the Administration tab.

Setup

- Basic Setup. Enter the Internet connection and network settings on this screen.
- DDNS. Use this screen to enable and configure the Dynamic Domain Name System (DDNS) feature.
- Advanced Routing. On this screen, you can alter NAT and routing configurations.

Wireless

- Basic Wireless Settings. You can choose your wireless network settings on this screen.
- Wireless Security. Configure your wireless security settings on this screen.
- Wireless Access. This screen lets you control access to your wireless network.
- Advanced Wireless Settings. On this screen you can access the advanced wireless network settings.

Security

- Firewall. Use this screen to disable or enable the firewall, set up filters, and block WAN requests.
- VPN. On this screen you can control VPN passthrough and set up IPSec VPN tunnels.

Access Restriction

- Internet Access. This screen allows you to control the Internet usage and traffic on your local network.

Applications & Gaming

- Single Port Forwarding. Use this screen to set up common services or applications that require forwarding on a single port.
- Port Range Forwarding. To set up public services or other specialized Internet applications that require forwarding on a range of ports, use this screen.
- Port Triggering. To set up triggered ranges and forwarded ranges for Internet applications, click this tab.
- DMZ. To allow one local computer to be exposed to the Internet for use of special-purpose services, use this screen.
- QoS. Use Quality of Service (QoS) to assign different priority levels to different types of data transmissions.

Administration

- Management. On this screen, alter Gateway access, Simple Network Management Protocol (SNMP), Universal Plug and Play (UPnP), IGMP-Proxy (IGMP stands for Internet Group Multicast Protocol), and wireless management settings.
- Reporting. If you want to view or save activity logs, click this tab.
- Diagnostics. Use this screen to run a Ping test.
- Backup&Restore. On this screen, you can back up or restore the Gateway's configuration.
- Factory Defaults. If you want to restore the Gateway's factory default settings, use this screen.
- Firmware Upgrade. Click this tab if you want to upgrade the Gateway's firmware.
- Reboot. If you need to do a hard or soft reboot of the Gateway, use this screen.

Status

- Gateway. This screen provides status information about the Gateway.
- Local Network. This provides status information about the local network.

***vpn** (virtual private network): a security measure to protect data as it leaves one network and goes to another over the Internet.*

- Wireless. This screen provides status information about the wireless network.
- DSL Connection. This screen provides status information about the DSL connection.

How to Access the Web-based Utility

To access the web-based utility, launch Internet Explorer or Netscape Navigator, and enter the Gateway's default IP address, **192.168.1.1**, in the *Address* field. Then press **Enter**.

A login screen will appear (Windows XP users will see a similar screen). Enter **admin** (the default user name) in the *User Name* field, and enter **admin** (the default password) in the *Password* field. Then click the **OK** button.

Figure 5-1: Login Screen

The Setup Tab

The Basic Setup Tab

The first screen that appears is the Basic Setup tab. This tab allows you to change the Gateway's general settings. Change these settings as described here and click the **Save Settings** button to save your changes, or click the **Cancel Changes** button to cancel your changes.

Internet Setup

- PVC Connection. If your ADSL account provides more than one permanent virtual circuit (PVC), you can have multiple, simultaneous, independent WAN connections. PVC 1 is selected and enabled by default. When you are ready to configure another PVC, select its number here and click the **Enable Now** box to enable it.
- Internet Connection Type. The Gateway supports six Encapsulation methods: RFC 1483 Bridged, RFC 1483 Routed, IPoA, RFC 2516 PPPoE, RFC 2364 PPPoA, and Bridged Mode Only. Select the appropriate type of encapsulation from the drop-down menu. Each *Basic Setup* screen and available features will differ depending on what type of encapsulation you select.
- VC Settings. You will configure your Virtual Circuit (VC) settings in this section.
  - Multiplexing: Select **LLC** or **VC**, depending on your ISP.
  - QoS Type: Select from the drop-down menu: **UBR** (Unspecific Bit Rate) for applications that are non-time-sensitive, such as e-mail; **CBR** (Continuous Bit Rate) to specify fixed bandwidth for voice or data traffic; or **VBR** (Variable Bit Rate) for bursty traffic and bandwidth-sharing with other applications.

Figure 5-2: Basic Setup

- Pcr Rate: For the Peak Cell Rate, divide the DSL line rate by 424 to get the maximum rate the sender can send cells. Enter the rate in the field (if required by your service provider).
- Scr Rate: The Sustain Cell Rate sets the average cell rate that can be transmitted. The SCR value is normally less than the PCR value. Enter the rate in the field (if required by your service provider).
- Autodetect: Select **Enable** to have the settings automatically entered, or select **Disable** to enter the values manually.
- Virtual Circuit: These fields consist of two items: VPI (Virtual Path Identifier) and VCI (Virtual Channel Identifier). Your ISP will provide the correct settings to use here for each of your PVCs.
- DSL Modulation: Your ISP can tell you if you should leave this control set to **MultiMode** or set it to **T1.413**, **G.dmt**, **G.lite**, **ADSL2**, or **ADSL2+**.

- IP Settings. Follow the instructions in the section for your type of encapsulation.

RFC 1483 Bridged

Dynamic IP

IP Settings. Select **Obtain an IP Address Automatically** if your ISP says you are connecting through a dynamic IP address. If your ISP says you should enable **PPPoE Session**, enable it and configure the following settings:

- Service Name. If a service name is required, enter the name of your PPPoE service in this field.
- User Name and Password. Enter the User Name and Password provided by your ISP.
- Connect on Demand: Max Idle Time. You can configure the Gateway to disconnect the Internet connection after it has been inactive for a specified period of time (Max Idle Time). If your Internet connection has been terminated due to inactivity, Connect on Demand enables the Gateway to automatically re-establish your connection as soon as you attempt to access the Internet again. To use this option, click the **Connect on Demand** radio button. In the *Max Idle Time* field, enter the number of minutes you want to have elapsed before your Internet connection terminates.
- Keep Alive: Redial Period. If you select this option, the Gateway will periodically check your Internet connection. If you are disconnected, then the Gateway will automatically re-establish your connection. To use this option, click the **Keep Alive** radio button. In the *Redial Period* field, specify how often you want the Gateway to check the Internet connection. The default Redial Period is **20** seconds.

Figure 5-3: RFC 1483 Bridged - Dynamic IP

Static IP

If you are required to use a permanent (static) IP address to connect to the Internet, then select **Use the following IP Address**.

- Internet IP Address. This is the Gateway's IP address, when seen from the WAN, or the Internet. Your ISP will provide you with the IP Address you need to specify here.
- Subnet Mask. This is the Gateway's Subnet Mask. Your ISP will provide you with the Subnet Mask.
- Gateway. Your ISP will provide you with the default Gateway Address, which is the ISP server's IP address.
- Primary DNS (Required) and Secondary DNS (Optional). Your ISP will provide you with at least one DNS (Domain Name System) Server IP Address.
- PPPoE Session. Enable this function if it is required by your ISP. PPPoE settings will appear. See "RFC 2516 PPPoE" on the next page for explanations of these settings.

Figure 5-4: RFC 1483 Bridged - Static IP

RFC 1483 Routed

If you are required to use RFC 1483 Routed, then select **RFC 1483 Routed**.

- Internet IP Address. This is the Gateway's IP address, when seen from the WAN, or the Internet. Your ISP will provide you with the IP Address you need to specify here.
- Subnet Mask. This is the Gateway's Subnet Mask. Your ISP will provide you with the Subnet Mask.
- Gateway. Your ISP will provide you with the default Gateway Address, which is the ISP server's IP address.
- Primary DNS (Required) and Secondary DNS (Optional). Your ISP will provide you with at least one DNS (Domain Name System) Server IP Address.

Figure 5-5: RFC 1483 Routed

IPoA

If you are required to use Internet Protocol over Asynchronous Transfer Mode, select **IPoA**. The related settings are the same as for RFC 1483 Routed (see above).

Figure 5-6: IPoA

RFC 2516 PPPoE

Some DSL-based ISPs use PPPoE (Point-to-Point Protocol over Ethernet) to establish Internet connections. Check with your ISP to see if they use PPPoE. If they do, you will have to enable PPPoE.

- Service Name. If a service name is required, enter the name of your PPPoE service in this field.
- User Name and Password. Enter the User Name and Password provided by your ISP.
- Connect on Demand: Max Idle Time. You can configure the Gateway to disconnect the Internet connection after it has been inactive for a specified period of time (Max Idle Time). If your Internet connection has been terminated due to inactivity, Connect on Demand enables the Gateway to automatically re-establish your connection as soon as you attempt to access the Internet again. To use this option, click the **Connect on Demand** radio button. In the *Max Idle Time* field, enter the number of minutes you want to have elapsed before your Internet connection terminates.
- Keep Alive: Redial Period. If you select this option, the Gateway will periodically check your Internet connection. If you are disconnected, then the Gateway will automatically re-establish your connection. To use this option, click the **Keep Alive** radio button. In the *Redial Period* field, specify how often you want the Gateway to check the Internet connection. The default Redial Period is **20** seconds.
- Second PPPoE. If your DSL account allows multiple simultaneous PPPoE streams, enable this option and enter the required information.

Figure 5-7: RFC 2516 PPPoE

RFC 2364 PPPoA

Some DSL-based ISPs use PPPoA (Point-to-Point Protocol over ATM) to establish Internet connections. If you are connected to the Internet through a DSL line, check with your ISP to see if they use PPPoA. If they do, you will have to enable PPPoA.

- User Name and Password. Enter the User Name and Password provided by your ISP.
- Connect on Demand: Max Idle Time. You can configure the Gateway to disconnect the Internet connection after it has been inactive for a specified period of time (Max Idle Time). If your Internet connection has been terminated due to inactivity, Connect on Demand enables the Gateway to automatically re-establish your connection as soon as you attempt to access the Internet again. To use this option, click the **Connect on Demand** radio button. In the *Max Idle Time* field, enter the number of minutes you want to have elapsed before your Internet connection terminates.
- Keep Alive: Redial Period. If you select this option, the Gateway will periodically check your Internet connection. If you are disconnected, then the Gateway will automatically re-establish your connection. To use this option, click the **Keep Alive** radio button. In the *Redial Period* field, specify how often you want the Gateway to check the Internet connection. The default Redial Period is **20** seconds.

Figure 5-8: RFC 2364 PPPoA

Bridged Mode Only

If you are using your Gateway as a bridge, which makes the Gateway act like a stand-alone modem, select **Bridged Mode Only**. All NAT and routing settings are disabled in this mode.

Figure 5-9: Bridged Mode Only

Optional Settings (required by some ISPs)

- Host Name and Domain Name. These fields allow you to supply a host and domain name for the Gateway. Some ISPs require these names as identification. You may have to check with your ISP to see if your broadband Internet service has been configured with a host and domain name. In most cases, you can leave these fields blank.

- MTU and Size. The MTU (Maximum Transmission Unit) setting specifies the largest packet size permitted for network transmission. Select **Manual** and enter the value desired in the *Size* field. It is recommended that you leave this value in the 1200 to 1500 range. By default, MTU is configured automatically.

Network Setup

- Router IP. The values for the Gateway's Local IP Address and Subnet Mask are shown here. In most cases, keeping the default values will work.
  - Local IP Address. The default value is **192.168.1.1**.
  - Subnet Mask. The default value is **255.255.255.0**.
- Network Address Server Settings (DHCP). Configure the Gateway's Dynamic Host Configuration Protocol (DHCP) settings in this section.
  - Local DHCP Server. A Dynamic Host Configuration Protocol (DHCP) server automatically assigns an IP address to each computer on your network for you. Unless you already have one, it is highly recommended that you leave the Gateway enabled as a DHCP server. You can also use the Gateway in DHCP Relay mode.
  - DHCP Relay Server. If you enable the DHCP Relay mode for the *Local DHCP Server* setting, enter the IP address for the DHCP server in the fields provided.
  - Advanced. To have the DHCP server reserve certain IP addresses for certain machines, click **Advanced**, enter each machine's MAC address or host name along with the desired IP address, and enable the entry.
  - Starting IP Address. Enter a value for the DHCP server to start with when issuing IP addresses. This value must be 192.168.1. 2 or greater, because the default IP address for the Gateway is 192.168.1.1.
  - Maximum Number of DHCP Users. Enter the maximum number of users/clients that can obtain an IP address. The number will vary depending on the starting IP address entered.

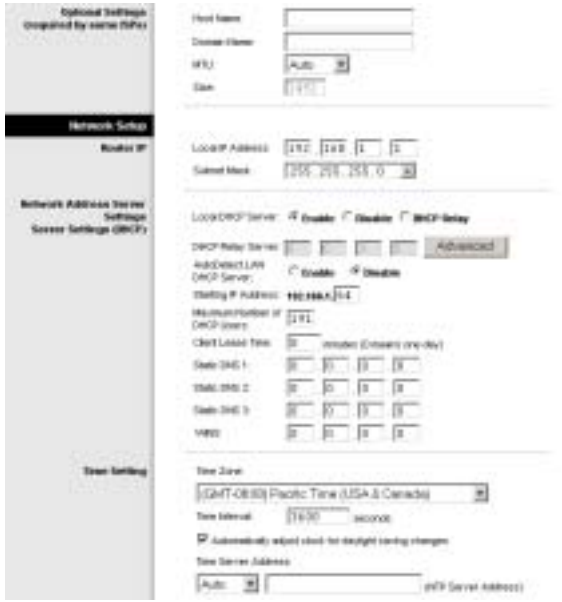

Figure 5-10: Optional Settings

Figure 5-11: Advanced DHCP

- Client Lease Time. The Client Lease Time is the amount of time a computer will be allowed connection to the Gateway with its current dynamic IP address. Enter the amount of time, in minutes, that the computer will be "leased" this dynamic IP address.

- Static DNS 1-3. The Domain Name System (DNS) is how the Internet translates domain or website names into Internet addresses or URLs. Your ISP will provide you with at least one DNS Server IP Address. You can enter up to three DNS Server IP Addresses here. The Gateway will use these for quicker access to functioning DNS servers.

- WINS. The Windows Internet Naming Service (WINS) converts NetBIOS names to IP addresses. If you use a WINS server, enter that server's IP address here. Otherwise, leave this field blank.

- Time Setting. Select the appropriate time zone. You can change the interval between Network Time Protocol (NTP) requests (normally 3600 seconds). If desired, check the **Automatically adjust clock for daylight saving changes** checkbox. To use a specific NTP server, select **Manual** and enter the server address.

When finished making your changes on this tab, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

The DDNS Tab

The Gateway offers a Dynamic Domain Name System (DDNS) feature. DDNS lets you assign a fixed host and domain name to a dynamic Internet IP address. It is useful when you are hosting your own website, FTP server, or other server behind the Gateway.

Before you can use this feature, you need to sign up for DDNS service at DynDNS.org or TZO.com.

DDNS

DDNS Service. If your DDNS service is provided by DynDNS.org, then select **DynDNS.org** from the drop-down menu. If your DDNS service is provided by TZO.com, then select **TZO.com** from the drop-down menu.To disable DDNS Service, select **Disabled**.

DynDNS.org

- User Name, Password, and Host Name. Enter the User Name, Password, and Host Name of the account you set up with DynDNS.org.
- Internet IP Address. The Gateway's current Internet IP Address is displayed here. Because it is dynamic, it will change.
- Status. The status of the DDNS service connection is displayed here.

TZO.com

- E-mail Address, Password, and Domain Name. Enter the E-mail Address, Password, and Domain Name of the account you set up with TZO.
- Internet IP Address. The Gateway's current Internet IP Address is displayed here. Because it is dynamic, this will change.
- Status. The status of the DDNS service connection is displayed here.

When finished making your changes on this tab, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

Figure 5-12: DynDNS.org

Figure 5-13: TZO.com

The Advanced Routing Tab

The *Advanced Routing* screen allows you to configure NAT (Network Address Translation), dynamic routing, static routing, and PVC routing settings.

Figure 5-14: Advanced Routing

Advanced Routing

- Operating Mode. In this section, you can disable or enable the Network Address Translation (NAT) feature.
  - NAT. NAT is a security feature that is enabled by default. It enables the Gateway to translate IP addresses of your LAN to a different IP address for the Internet. To disable NAT, click the **Disable** button.
- Dynamic Routing. If you have one or more other gateways or routers on your network, you may need to enable dynamic routing, static routing, or both. In dynamic routing, the Gateway learns routes to other networks by periodically communicating with other gateways and routers using RIP, the Routing Information Protocol. Dynamic routing lets the Gateway automatically adjust to changes in the network's layout.
  - RIP. If you have multiple routers, you may want to use RIP so the routers can exchange routing information with each other. To use RIP, select the **Enabled** radio button. Otherwise, keep the default, **Disabled**.
  - Transmit RIP Version. To transmit RIP messages, select the protocol you want: **RIP1**, **RIP1-Compatible** (RIP1 broadcasts and RIP2 multicasts), or **RIP2**. If you don't want to transmit RIP messages, select **Disable**.
  - Receive RIP Version. To receive RIP messages, select the protocol you want: **RIP1** or **RIP2**. If you don't want to receive RIP messages, select **Disable**.
- Static Routing. For static routing, you input fixed routes to other networks by hand. This can be done to ensure that information travels by the most efficient path, or to avoid the overhead of RIP. To create a static route, change the following settings:
  - Select set number. Select the number of the static route from the drop-down menu. The Gateway supports up to 20 static route entries. If you need to delete a route, then select the entry and click the **Delete This Entry** button.
  - Destination IP Address. The Destination IP Address is the IP address of the remote network or host that will be reached through the static route. Note that a network address almost always ends in 0, and a host address never ends in 0.
  - Subnet Mask. Enter the Subnet Mask (also known as the Network Mask), which determines which portion of an IP address is the network portion, and which portion is the host portion.

- Gateway. Enter the IP address of the gateway device that allows for contact between the Gateway and the remote network or host.
- Hop Count. Hop Count is the number of hops to each node until the destination is reached (16 hops maximum). Enter the Hop Count in the field provided.

- Show Routing Table. Click the **Show Routing Table** button to open a screen displaying how data is routed through your local network. For each route, the Destination LAN IP address, Subnet Mask, Gateway, and Interface are displayed. Click the **Refresh** button to update the information. Click the **Close** button to return to the previous screen.

Figure 5-15: Routing Table

- PVC Routing Policy. If you have two or more PVCs, click the **PVC Routing Setting** button to configure which outgoing traffic will be routed over which PVC. A window titled PVC Selection Table will appear. Open the **Please select Active Connection** list and specify the PVC for which you will select traffic. Traffic can be selected on the basis of the following criteria, alone or in any combination:
  - Destination (IP address and address mask)
  - Source (IP address and address mask, or MAC address)
  - Transport protocol (TCP, UDP, or All)
  - Destination port and/or source port (if protocol is set to TCP or UDP)
  - Presence of a specified IEEE 802.1D user priority marker
  - IEEE 802.3 Type/Length value (the value in the 13th and 14th octets of an Ethernet frame)
  - Presence of a specified IEEE 802.1Q virtual LAN (VLAN) ID
  - Packet length between specified minimum and maximum numbers of octets
  - Presence of a specified DSCP (Diffserv Code Point) value (one kind of QoS marker)

  To enable the selection criteria on one row of the table, click that row's **Apply** box so a check appears in it. To disable the row's criteria, click the box to clear it. When you have finished making changes in this window, click the **Save** button to save the changes, or click the **Cancel** button to undo your changes. Then click **Close**. You will be returned to the Advanced Routing panel.

Figure 5-16: PVC Routing

When finished making changes in the Advanced Routing panel, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

The Wireless Tab

The Basic Wireless Settings Tab

This screen allows you to choose your wireless network mode and wireless security.

Wireless Network

- Wireless Network Mode. If you have both 802.11g and 802.11b devices in your network, then keep the default setting, **Mixed**. If you have only 802.11g devices, select **G-Only**. If you have only 802.11b devices, select **B-Only**. If you want to disable wireless networking, select **Disable**.
- Wireless Network Name (SSID). Enter the name for your wireless network into the field. The SSID is the network name shared among all devices in a wireless network. It must be identical for all devices in the wireless network. It is case-sensitive and must not exceed 32 alphanumeric characters, which may be any keyboard character. Linksys recommends that you change the default SSID (linksys) to a unique name of your choice.
- Wireless Channel. Select the appropriate channel from the list provided to correspond with your network settings. All devices in your wireless network must use the same channel in order to function correctly. Wireless clients (computers and other devices that can use a wireless network) will automatically detect the wireless channel of the Gateway.
- Wireless SSID Broadcast. The Gateway normally broadcasts its SSID periodically so wireless clients in the area can more easily detect the network and associate with it. To broadcast the Gateway's SSID, keep the default setting, **Enable**. If you do not want to broadcast the Gateway's SSID, then select **Disable**.

When finished making your changes on this tab, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

Figure 5-17: Basic Wireless Settings

The Wireless Security Tab

The Wireless Security settings configure the security of your wireless network. There are three wireless security options supported by the Gateway: WPA Pre-Shared Key, WPA RADIUS and WEP. (WPA stands for Wi-Fi Protected Access, which is a security standard stronger than WEP encryption. WEP stands for Wired Equivalent Privacy. RADIUS stands for Remote Authentication Dial-in User Service.) These are briefly discussed here. For detailed instructions on configuring wireless security for the Gateway, turn to "Appendix B: Wireless Security." If you want to disable wireless security, select **Disable** from the drop-down menu for Security Mode.

Figure 5-18: WPA Pre-Shared Key

WPA Pre-Shared Key

WPA Pre-Shared Key is also known as WPA PSK or WPA Personal. Enter a WPA Pre-Shared Key of 8-32 characters. Then enter a Group Key Renewal period, which instructs the Gateway how often it should generate new encryption keys.

WPA RADIUS

This option, also known as WPA Enterprise, requires that a RADIUS server be connected to the network. Enter the RADIUS server's IP address. If the server is not using the usual RADIUS port number (1812), enter the port number it is using. Then enter the shared key used by the RADIUS server. If you wish, you can change the Key Renewal Timeout setting (default 3600 seconds, or one hour), which instructs the Gateway how often it should generate new encryption keys.

Figure 5-19: WPA RADIUS

WEP

WEP is a basic encryption method that is not as secure as WPA. WEP lets you use from one to four 64-bit encryption keys or a single 128-bit encryption key (64-bit WEP is sometimes referred to as 40-bit WEP). All devices on the wireless network must use exactly the same key or keys. Select the desired key length from the WEP Encryption drop-down list box.

When you use multiple keys, they must be ordered identically (that is, placed in the same numbered "slots") on each device. The Gateway can decrypt transmissions encrypted with any one of the keys. Use the Default Transmit Key control to indicate which key the Gateway should use to encrypt its own transmissions.

When you use a single key, it must be entered or generated in the Key 1 box, and the Default Transmit Key control must be set to Key 1.

Keys must be set using "hex" (hexadecimal, that is, base 16) numeric notation. The hex digits are the numerals 0 through 9 and the letters A through F. Settings in hex notation are not case-sensitive.

If you need to set the Gateway to communicate with devices using WEP keys set in so-called ASCII (plain-text) format, consult a hexadecimal ASCII chart to find the hex values of the characters. To give an example of such a conversion, a key consisting of the string GHIJK in ASCII format would be 4748494a4b in hex format. (Two hex digits are required for every character of a key in ASCII format.)

You can generate keys by typing an alphanumeric passphrase up to 32 characters long and clicking the Generate button. The passphrase setting is case-sensitive, although the resulting key settings are not. The same passphrase will generate the same keys on all Linksys products, but not on non-Linksys products with a Passphrase function. Copy generated keys manually to use them on such products.

Figure 5-20: WEP

You can also input the key or keys manually, by typing in the key input boxes. 64-bit keys must be made up of exactly 10 hex digits, while a 128-bit key must be made up of exactly 26 hex digits.

When finished making your changes on this tab, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes. For detailed instructions on configuring wireless security for the Gateway, turn to "Appendix B: Wireless Security."

The Wireless Access Tab

Wireless Network Access

Wireless Network Access. Select **Allow All** you want all computers to have access to the wireless network. To restrict access to the network, select **Restrict Access**, and then select **Prevent** to block access for the designated computers or **Permit only** to permit access for the designated computers. Click the **Edit MAC Address Access List** button, and the *Mac Address Filter List* screen will appear.

Enter the MAC addresses of the computers you want to designate. To see a list of MAC addresses for wireless computers or clients, click the **Wireless Client MAC List** button.

The *Wireless Client MAC List* screen will list computers, their IP addresses, and their MAC addresses. Click the Refresh button to get the most up-to-date information. To add a specific computer to the Mac Address Filter List, click the **Enable MAC Filter** checkbox and then the **Update Filter List** button. Click the **Close** button to return to the *Wireless Client MAC List* screen.

On the *Wireless Client MAC List* screen, click the **Save Settings** button to save this list, or click the **Cancel Changes** button to remove your entries.

When finished making your changes on this tab, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

Figure 5-21: Wireless Network Access

Figure 5-22: MAC Address Filter List

Figure 5-23: Wireless Client MAC List

The Advanced Wireless Settings Tab

Advanced Wireless

On this screen you can access the advanced wireless features, including Authentication Type, Control TX Rate, Beacon Interval, DTIM Interval, Fragmentation Threshold, and RTS Threshold.

Figure 5-24: Advanced Wireless Settings

- Authentication Type. The default is set to **Auto**, which allows either Open System or Shared Key authentication to be used. For Open System authentication, the sender and the recipient do not use a WEP key for authentication but can use WEP for data encryption. For Shared Key authentication, the sender and recipient use a WEP key for both authentication and data encryption. To only allow Shared Key authentication, select **Shared Key**. It is recommended that this option be left in the default (Auto) mode, because some clients cannot be configured for Shared Key.

- Control Tx Rates The default transmission rate is **Auto**. The rate should be set depending on the speed of your wireless network. Select from a range of transmission speeds, or keep the default setting, **Auto**, to have the Gateway automatically use the fastest possible data rate and enable the Auto-Fallback feature. Auto-Fallback will negotiate the best possible connection speed between the Gateway and a wireless client.

- Beacon Interval. The default value is **100**. The Beacon Interval value indicates the frequency interval of the beacon. A beacon is a packet broadcast by the Gateway to synchronize the wireless network.

- DTIM Interval. The default value is **1**. This value indicates the interval of the Delivery Traffic Indication Message (DTIM). A DTIM field is a countdown field informing clients of the next window for listening to broadcast and multicast messages. When the Gateway has buffered broadcast or multicast messages for associated clients, it sends the next DTIM with a DTIM Interval value. Its clients hear the beacons and awaken to receive the broadcast and multicast messages.

- Fragmentation Threshold. This value should remain at its default setting of **2346**. It specifies the maximum size for a packet before data is fragmented into multiple packets. If you experience a high packet error rate, you may slightly increase the Fragmentation Threshold. Setting the Fragmentation Threshold too low may result in poor network performance. Only minor modifications of this value are recommended.

- RTS Threshold. This value should remain at its default setting of **2347**. If you encounter inconsistent data flow, only minor modifications are recommended. If a network packet is smaller than the preset RTS threshold size, the RTS/CTS mechanism will not be enabled. The Gateway sends Request to Send (RTS) frames to a particular receiving station and negotiates the sending of a data frame. After receiving an RTS, the wireless station responds with a Clear to Send (CTS) frame to acknowledge the right to begin transmission.

When finished making your changes on this tab, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

The Security Tab

The Security tab gives you access to firewall and VPN (virtual private network) settings.

The Firewall Tab

This panel shows firewall and filter settings. Use these features to enhance the security of your network.

Firewall

You can enable or disable the firewall, select filters to block specific Internet data types, and block anonymous Internet requests.

To use the firewall, click **Enable**. If you do not want to use the firewall, click **Disable**.

Figure 5-25: Firewall

Additional Filters

- Filter Proxy. Use of WAN proxy servers may compromise the Gateway's security. Denying Filter Proxy will disable access to any WAN proxy servers. To enable proxy filtering, click the checkbox.
- Filter Cookies. A cookie is data stored on your computer and used by Internet sites when you interact with them. To enable cookie filtering, click the checkbox.
- Filter Java Applets. Java is a programming language for websites. If you deny Java Applets, you run the risk of not having access to Internet sites created using this programming language. To enable Java Applet filtering, click the checkbox.
- Filter ActiveX. ActiveX is a programming language for websites. If you deny ActiveX, you run the risk of not having access to Internet sites created using this programming language. To enable ActiveX filtering, click the checkbox.

Block WAN Requests

- Block Anonymous Internet Requests. This keeps your network from being “pinged” or detected and reinforces your network security by hiding your network ports, so it is more difficult for intruders to discover your network. Select **Block Anonymous Internet Requests** to block anonymous Internet requests or de-select it to allow anonymous Internet requests.

If you want to see activity logs for your security measures, then click the **View Logs** button. Click the **Clear** button to clear the log information. Click the **pageRefresh** button to refresh the information. Click the **Previous**

Figure 5-26: Firewall Log

Page button to go to the previous page of information. Click the **Next Page** button to move to the next page of information.

When finished making your changes on this tab, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

The VPN Tab

This panel shows VPN (virtual private network) settings. You can disable or enable passthrough for four kinds of VPNs. You can also set up IPSec (Internet Protocol Security) VPN tunnels for secure remote access.

VPN Passthrough

Virtual Private Networking (VPN) is a security measure that basically creates a secure connection between two remote locations. Configure these settings so the Gateway will permit VPN tunnels to pass through.

- IPSec Passthrough. Internet Protocol Security (IPSec) is a suite of protocols used to implement secure exchange of packets at the IP layer. To allow IPSec Passthrough, click the **Enable** button. To disable IPSec Passthrough, click the **Disable** button.
- PPPoE Passthrough. PPPoE Passthrough allows your PC(s) to use the PPPoE client software provided by your ISP. Some ISPs may request that you use this feature on the Gateway. To allow PPPoE Passthrough, click the **Enable** button. To disable PPPoE Passthrough, click the **Disable** button.
- PPTP Passthrough. Point-to-Point Tunneling Protocol Passthrough is the method used to enable VPN sessions to a Windows NT 4.0 or 2000 server. To allow PPTP Passthrough, click the **Enable** button. To disable PPTP Passthrough, click the **Disable** button.
- L2TP Passthrough. Layering 2 Tunneling Protocol Passthrough is an extension of the Point-to-Point Tunneling Protocol (PPTP) used to enable the operation of a VPN over the Internet.To allow L2TP Passthrough, click the **Enable** button. To disable L2TP Passthrough, click the **Disable** button.

IPSec VPN Tunnel

Use this section of the VPN panel to set up, enable, and disable secure IPSec tunnels between the Gateway and remote IPSec gateways and clients. Note that you must have a working ADSL connection to complete the settings in this section.

- Select Tunnel Entry: You can enable up to five IPSec tunnels. Each has a number and a name. Use this control to select the one you want to enable, disable, edit, or delete.

Figure 5-27: VPN

- Delete: Click this button to delete the selected tunnel.
- Summary: Click this button to see a summary of your IPSec settings and the tunnels' status.
- IPSec VPN Tunnel: Click Enabled to enable the selected tunnel, or Disabled to disable it.
- Tunnel Name: Click and type in this box to give the selected tunnel a name. A name is required, but is only for your reference and need not match the name used at the remote gateway or client.

- Local Secure Group: To give an entire local network access to the tunnel, select Subnet and enter the network address and mask. To give a particular host access to the tunnel, select IP Address and enter the host's address and mask.
- Local Security Gateway: If you have multiple PVCs, open this list and select the PVC you wish to use for the VPN tunnel.
- Remote Secure Group: Use this control to specify the remote device or devices that will be granted access to the tunnel. This can be the public IP address of a network or host; the IP address and mask of a remote subnet; Host, that is, identical to the Remote Security Gateway setting; or Any, which allows any device with permission from the remote security gateway to access the tunnel.
- Remote Security Gateway: Use the controls in this section to specify the remote endpoint of the IPSec tunnel, whether it will be a gateway or a client. Select **IP Address** or **FQDN** (fully qualified domain name) and input the correct address or name; or select **Any**, which allows any machine with the correct IPSec settings to act as the remote endpoint of the tunnel.
  - Encryption: To have communication through the tunnel encrypted, select DES (Data Encryption Standard) or 3DES (Triple DES). To leave communication unencryped, select Disable.
  - Authentication: Authentication verifies the identity of the remote machine and the integrity of the data received. Set this control to MD5 (Message Digest 5) or SHA (Secure Hash Algorithm). SHA is newer, and generally considered more secure, than MD5.
- Key Management: A key is a string of letters and/or numbers that is used for authentication or encryption. Key management can be automatic (performed by IKE, the Internet Key Exchange protocol) or manual.
  - *To use automatic key management*, select Auto.(IKE), enter the pre-shared key and the key lifetime, and enable or disable PFS (perfect forward secrecy). The key should be a string of 8 to 23 characters representing no dictionary word or numeric pattern. PFS enhances security by enabling automatic re-keying. The settings must exactly match those at the remote end of the tunnel.

Figure 5-28: VPN Settings Summary

- *To use manual key management*, select Manual, enter authentication and encryption keys (these must be identical to those entered at the remote end), and enter inbound and outbound SPIs (security parameter indexes). The SPIs must be exactly complementary to those entered at the remote end.

When you select automatic key management, an Advanced Settings button appears. Click this button if there are special requirements for this IPSec tunnel. The Advanced IPSec VPN Tunnel Setup window will appear. (Help for this window can be displayed by clicking More on the right side of the VPN panel.)

In this window you can set parameters for IKE phases 1 and 2, and other settings. Phase 1 is when the two ends negotiate parameters for key exchange; phase 2 is when they negotiate parameters for data exchange.

- Operation mode: Key exchange parameters can be negotiated in Main mode, which is more secure, or Aggressive mode, which is quicker. The Gateway will accept requests in either mode, but some gateways and clients will accept requests only in the mode specified by the user.
- Proposal 1: A proposal is a set of parameters that the initiator sends and the responder examines for acceptability. You can specify encryption and authentication algorithms, Diffie-Hellman group, and key lifetime for the first proposal.
- Phase 2 Proposal: Select the desired Diffie-Hellman group, 768-bit or 1024-bit.
- Other Settings

  NAT Traversal: Enable this feature if the machine or machines being accessed through the tunnel stand behind a NAT (Network Address Translation) server.

  NetBIOS broadcast: Enable this feature if the local network does not include a WINS server and the remote machine or machines will need to find local machines by their NetBIOS (Windows Networking) names.

  Anti-replay: Packets sent through an IPSec tunnel contain sequencing numbers to let the receiver detect if a substitution has occurred. You can enable this function for greater security.

  Keep-alive: This feature, enabled by default, makes the Gateway check the tunnel connection periodically and attempt to re-establish it if it goes down.

  If IKE failed . . . : IKE failure may signify an unwanted intrusion attempt. You can set a limit on the number of consecutive failed requests that the Gateway will allow from the same IP address, and the amount of time that the Gateway will ignore further requests from that address.

When finished making changes in this panel, click the **Save Settings** button to save your changes, or click **Cancel Changes** to undo the changes. Use the VPN panel's **Connect** and **View Logs** buttons to test the tunnel.

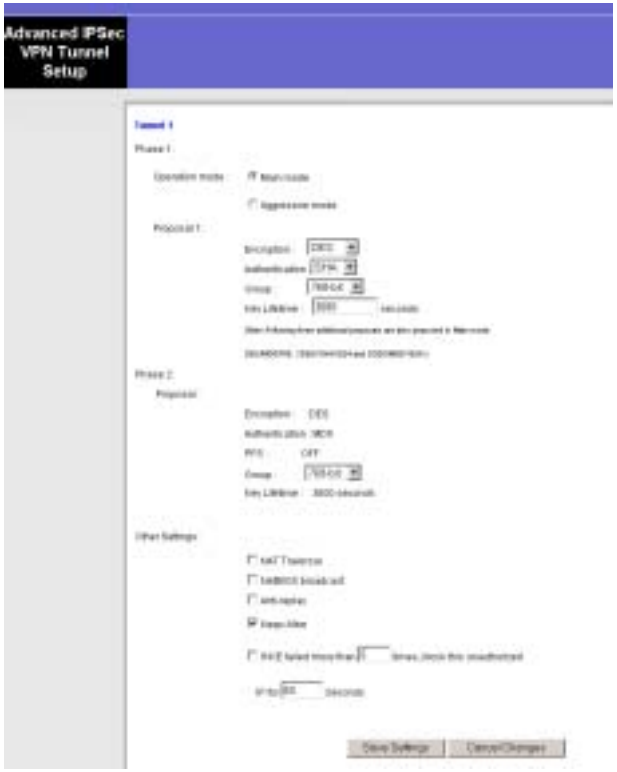

Figure 5-29: Advanced IPSec Settings

Figure 5-30: VPN Log

The Access Restriction Tab

The Internet Access Tab

The *Internet Access* screen allows you to block or allow specific kinds of Internet usage. You can set up Internet access policies for specific computers and block websites by URL address or keyword.

Internet Access Policy. Access can be managed by a policy. Use the settings on this screen to establish an access policy (after the **Save Settings** button is clicked). Selecting a policy from the drop-down menu will display that policy's settings. To delete a policy, select that policy's number and click the **Delete** button. To view all the policies, click the **Summary** button. (Policies can be deleted from the *Summary* screen by selecting the policy or policies and clicking the **Delete** button. To return to the Internet Access screen, click the **Close** button.)

Status. Policies are disabled by default. To enable a policy, select the policy number from the drop-down menu, and click the radio button beside *Enable*.

To create an Internet Access policy:

1. Select a number from the *Internet Access Policy* drop-down menu.
2. To enable this policy, click the radio button beside *Enable*.
3. Enter a Policy Name in the field provided.

Figure 5-31: Internet Access

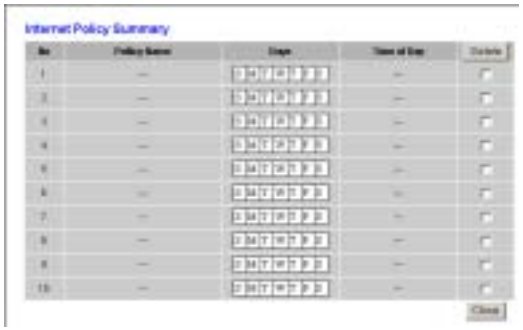

Figure 5-32: Internet Policy Summary

4. Click the **Edit List of PCs** button to select which PCs will be affected by the policy. The *List of PCs* screen will appear. You can select a PC by MAC Address or IP Address, and you can enter a range of IP Addresses to select a group of PCs. You can also make the policy apply for particular WAN IP addresses. After making your changes, click the **Save Settings** button to apply your changes or **Cancel Changes** to cancel your changes.

5. Click the appropriate option, **Deny** or **Allow**, depending on whether you want to block or allow Internet access for the PCs you listed on the *List of PCs* screen.

6. Decide which days and what times you want this policy to be enforced. Select the individual days during which the policy will be in effect, or select **Everyday**. Then enter a range of hours and minutes during which the policy will be in effect, or select **24 Hours**.

7. If you want to block websites with specific URL addresses, enter each URL in a separate field next to *Website Blocking by URL Address*.

8. If you want to block websites using specific keywords, enter each keyword in a separate field next to *Website Blocking by Keyword*.

9. You can filter access to various services accessed over the Internet, such as FTP or telnet, by selecting services from the drop-down menus next to *Blocked Services*.

   Then enter the range of ports you want to filter.

   If the service you want to block is not listed or you want to edit a service's settings, then click the **Add/Edit Service** button. Then the *Port Services* screen will appear.

   To add a service, enter the service's name in the *Service Name* field. Select its protocol from the *Protocol* drop-down menu, and enter its range in the *Port Range* fields. Then click the **Add** button.

   To modify a service, select it from the list on the right. Change its name, protocol setting, or port range. Then click the **Modify** button.

   To delete a service, select it from the list on the right. Then click the **Delete** button.

   When you are finished making changes on the *Port Services* screen, click the **Apply** button to save changes. If you want to cancel your changes, click the **Cancel** button. To close the *Port Services* screen and return to the *Access Restrictions* screen, click the **Close** button.

10. Click the **Save Settings** button to save the policy's settings. To undo the policy's settings, click the **Cancel Changes** button.

Figure 5-33: List of PCs

Figure 5-34: Add/Edit Service

The Applications & Gaming Tab

The Single Port Forwarding Tab

Single Port Forwarding

Use the *Single Port Forwarding* screen when you want to open a specific port so users on the Internet can see the servers behind the Gateway (such servers may include FTP or e-mail servers). When users send this type of request to your network via the Internet, the Gateway will forward those requests to the appropriate computer. Any computer whose port is being forwarded should have its DHCP client function disabled and should have a new static IP address assigned to it because its IP address may change when using the DHCP function.

- PVC Connection Select. If the service requests you wish to configure will be coming in over a PVC other than PVC 1, select the correct PVC from this list.
- Port Map List. In this section you will customize the port service for your applications.
  - Application. Enter the name of the application in the field provided.
  - External Port and Internal Port. Enter the External and Internal Port numbers.
  - Protocol. Select the protocol you wish to use for each application: **TCP** or **UDP**.
  - IP Address. Enter the IP Address of the appropriate computer.
  - Enabled. Click **Enabled** to enable forwarding for the chosen application.

When finished making your changes on this tab, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

Figure 5-35: Single Port Forwarding

The Port Range Forwarding Tab

The *Port Range Forwarding* screen sets up public services on your network, such as web servers, ftp servers, e-mail servers, or other specialized Internet applications. (Specialized Internet applications are any applications that use Internet access to perform functions such as videoconferencing or online gaming. Some Internet applications may not require any forwarding.)

When users send this type of request to your network via the Internet, the Gateway will forward those requests to the appropriate computer. Any computer whose port is being forwarded should have its DHCP client function disabled and should have a new static IP address assigned to it because its IP address may change when using the DHCP function.

- Application. Enter the name of the application in the field provided.
- Start and End. Enter the starting and ending numbers of the port range you wish to forward.
- Protocol. Select the protocol you wish to use for each application: **TCP**, **UDP**, or **Both**.
- IP Address. Enter the IP Address of the appropriate computer.
- Enable. Click the **Enable** checkbox to enable forwarding for the chosen application.

When finished making your changes on this tab, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

Figure 5-36: Port Range Forwarding

The Port Triggering Tab

Port Triggering is used for special applications that can request a port to be opened on demand. For this feature, the Gateway will watch outgoing data for specific port numbers. The Gateway will remember the IP address of the computer that sends a transmission requesting data, so that when the requested data returns through the Gateway, the data is pulled back to the proper computer by way of IP address and port mapping rules.

- Application. Enter the name you wish to give each application.
- Triggered Range. Enter the starting and ending port numbers of the Triggered Range.
- Forwarded Range. Enter the starting and ending port numbers of the Forwarded Range.
- Enable. Click the **Enable** checkbox to enable port triggering for the chosen application.

When finished making your changes on this tab, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

Figure 5-37: Port Triggering

The DMZ Tab

The *DMZ* screen allows one local user to be exposed to the Internet for use of a special-purpose service such as Internet gaming and videoconferencing through DMZ Hosting. DMZ hosting forwards all the ports for one computer at the same time, which differs from Port Range Forwarding, which can only forward a maximum of 10 ranges of ports.

- DMZ Hosting. This feature allows one local user to be exposed to the Internet for use of a special-purpose service such as Internet gaming and videoconferencing. To use this feature, select **Enable**. To disable DMZ, select **Disable**.
- DMZ Host IP Address. To expose one computer, enter the computer's IP address. To get the IP address of a computer, refer to "Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter."

When finished making your changes on this tab, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

Figure 5-38: DMZ

The QoS Tab

QoS

Quality of Service (QoS) ensures better service to high-priority types of network traffic, which may involve demanding, real-time applications, such as Internet phone calls or videoconferencing.

Enabled/Disabled. To use QoS, select **Enable**. Otherwise, keep the default, **Disable**.

PVC QoS Priority

PVC-based QoS assigns different levels of priority, or precedence, to different permanent virtual circuits. This is useful when you have, for example, one PVC set up for traditional Internet services (Web browsing, e-mail, and the like) and another PVC set up to carry time-sensitive data such as VoIP or IPTV streams. Giving the second PVC a higher QoS level helps ensure the best possible voice or picture quality.

Figure 5-39: QoS

Edit list of QoS Settings

In addition to PVC-based QoS, you can assign different levels of priority to different packets based on information in the packets. To do this, click the Edit list of QoS Settings button. A window titled QoS Function will appear.

This window lets you set the priority for packets selected by any of the following criteria, alone or in combination:

- Destination (IP address and address mask, fully qualified domain name, or MAC address)
- Source (IP address and address mask, or MAC address)
- Transport protocol (TCP, UDP, or All)
- Destination port and/or source port (if protocol is set to TCP or UDP)
- Ethernet Type value (the value in the 13th and 14th octets of an Ethernet frame)
- Triggering of a particular application layer gateway (FTP, TFTP, H.323, IRC, MMS, GRE, PPTP, or SIP)
- Presence of a specified IEEE 802.1D user priority marker
- Presence of a specified IEEE 802.1Q virtual LAN (VLAN) ID
- Packet length between specified minimum and maximum numbers of octets.

Fragment packets' size of AF and BE traffic to be equal to the size of EF traffic: Enable this option and input a packet size to have large Assured Forwarding (medium priority) and Best Effort (low priority) packets fragmented so they will not uduly delay Expedited Forwarding (high priority) packets. The value you enter should be from 68 to 1492.

When you have finished making changes in this window, click the **Save** button to save the changes, or click the **Cancel** button to undo your changes. Then click **Close**. You will be returned to the QoS panel. Click the **Save Settings** button to save your changes, or click the **Cancel Changes** button to undo your changes.

Figure 5-40: Edit List of QoS Settings

The Administration Tab

The Management Tab

The *Management* screen allows you to change the Gateway's access settings as well as configure the SNMP (Simple Network Management Protocol), UPnP (Universal Plug and Play), IGMP (Internet Group Multicast Protocol)-Proxy, and WLAN management features.

Gateway Access

Local Gateway Access. To ensure the Gateway's security, you will be asked for your password when you access the Gateway's Web-based Utility. The default username and password is **admin**.

- Gateway Username. Enter the default username, **admin**. It is recommended that you change the default username to one of your choice.
- Gateway Password. It is recommended that you change the default password, **admin**, to one of your choice.
- Re-enter to confirm. Re-enter the Gateway's new Password to confirm it.

Remote Gateway Access. This feature allows you to access the Gateway from a remote location, via the Internet.

- Remote Management. This feature allows you to manage the Gateway from a remote location via the Internet. To enable Remote Management, click **Enable**.

IMPORTANT: Enabling remote management allows anyone with your password to configure the Gateway from somewhere else on the Internet.

- Remote Username. The default username for remove management is **tech**. It is recommended that you change the remote username to one of your own choosing.
- Remote Password. The default remote password is **admin**. It is recommended that you change this to a password of your own choosing.
- Re-enter to confirm. Re-enter the new remote password to confirm it.
- Management Port. Enter the port number you will use to remotely access the Gateway.
- Allowed IP. Specify the IP address(es) allowed to remotely manage the Gateway. To allow all IP addresses with no restrictions, select **All**. To specify a single IP address, select **IP address** and enter the IP address in the

Figure 5-41: Management

Figure 5-42: Allowed IP - IP Range

fields provided. To specify a range of IP addresses, select **IP range** and enter the range of IP addresses in the fields provided.

- Use https. Clear this check box if you do not want to use HTTPS encryption on remote management links.

Remote Upgrade. This feature allows the Gateway's firmware to be upgraded remotely by a TFTP server. To enable Remote Upgrade, click **Enable**.

SNMP

SNMP is a popular network monitoring and management protocol. To enable SNMP, click **Enabled**. To disable SNMP, click **Disabled**.

If enabled, then specify the IP address(es) allowed to have SNMP access. Select **All** to allow all IP addresses with no restrictions, **IPaddr** to specify a single IP address, or **IP range** to specify a range of IP addresses.

- Device Name. Enter the name of the Gateway.
- SNMP v1/v2: Get Community. Enter the password that allows read-only access to the Gateway's SNMP information.
- Set Community. Enter the password that allows read/write access to the Gateway's SNMP information.
- SNMP V3. Click **Enable** if you wish to manage the Gateway using SNMP version 3.
- Rw User. Enter a name for the user who will have read/write access to the Gateway's settings. The default name is **v3rwuser**.
- Authentication protocol and password. Select an authentication protocol and enter a password. It is recommended that the password be at least eight characters long.
- Privacy protocol and password. To enable encryption of SNMP version 3 communications, select **CBC-DES** and enter a password. If encryption is not desired, select **None**.
- Trap Management: Trap to. Enter the IP address of the remote host computer that will receive the trap messages.

UPnP

UPnP allows Windows Me and XP to automatically configure the Gateway for various Internet applications, such as gaming and videoconferencing.

- UPnP. To enable UPnP, click **Enable**. Otherwise, click **Disable**.
- Please select a PVC connection to bind. Select the number of the PVC over which the applications requiring UPnP will run.

IGMP-Proxy

If your multimedia application or device is not working properly behind the Gateway, then you can enable IGMP-Proxy to allow multicast traffic through the Gateway.

- PVC Available. Select the number of the PVC over which you wish IGMP-Proxy to work.
- IGMP Proxy. To use this feature, select **Enable**. Otherwise, select **Disable**.

IGMP-Snooping

The multicast packets used by some multimedia applications are treated as broadcast packets and sent to all of the Gateway's LAN ports. If this results in too much traffic going to ports over which the application is not being used, you can enable IGMP snooping to ensure correct routing of multicast traffic.

- IGMP Snooping. To use this feature, select **Enable**. Otherwise, select **Disable**.

WLAN

- Management via WLAN. This feature allows the Gateway to be managed by a wireless computer on the local network when it logs into the Gateway's Web-based Utility.

When finished making your changes on this tab, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

The Reporting Tab

The *Reporting* screen provides you with a log of all incoming and outgoing URLs or IP addresses for your Internet connection. It also provides logs for VPN and firewall events.

Reporting

- Log. To enable log reporting, click **Enable**.
- Logviewer IP Address. Enter the IP Address of the computer that will receive logs. You will need Logviewer software to view these logs. This free software is available for download from www.linksys.com.

Email Alerts

- E-Mail Alerts. To enable E-Mail Alerts, click **Enable**.
- Denial of Service Thresholds. Enter the number of Denial of Service attacks that will trigger an e-mail alert.
- SMTP Mail Server. Enter the IP address of the SMTP server.
- E-Mail Address for Alert Logs. Enter the e-mail address that will receive alert logs.
- Return E-Mail address. Enter the return address for the e-mail alerts.

To view the logs, click the **View Logs** button. A new screen will appear. From the drop-down menu, you can select which log you want to view. Click the **Clear** button to clear the log information. Click the **pageRefresh** button to refresh the information. Click the **Previous Page** button to go to the previous page of information. Click the **Next Page** button to move to the next page of information.

When finished making your changes on this tab, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

Figure 5-43: Reporting

Figure 5-44: System Log

The Diagnostics Tab

Ping Test

Ping Test Parameters

- Ping Target IP. Enter the IP address that you want to ping. This can be either a local (LAN) IP or an Internet (WAN) IP address.
- Ping Size. Enter the size of the packet.
- Number of Pings. Enter the number of times that you want to ping.
- Ping Interval. Enter the ping interval (how often the target IP address will be pinged) in milliseconds.
- Ping Timeout. Enter the ping timeout (how long before the ping test times out) in milliseconds.

Click the **Start Test** button to start the Ping Test.

- Ping Result. The results of the ping test will be shown here.

When finished making your changes on this tab, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

Figure 5-45: Ping Test

The Backup&Restore Tab

The Backup&Restore tab allows you to back up and restore the Gateway's configuration file.

Backup Configuration

To back up the Gateway's configuration file, click the **Backup** button. Then follow the on-screen instructions.

Restore Configuration

To restore the Gateway's configuration file, click the **Browse** button. Then follow the on-screen instructions to locate the file. After you have selected the file, click the **Restore** button.

Figure 5-46: Backup&Restore

The Factory Defaults Tab

Restore Factory Defaults. If you wish to restore the Gateway to its factory default settings and lose all your settings, click **Yes**.

To begin the restore process, click the **Save Settings** button to save these changes, or click the **Cancel Changes** button to undo your changes.

Figure 5-47: Factory Defaults

The Firmware Upgrade Tab

The Gateway allows you to upgrade firmware from the LAN (Local Area Network) side of the Gateway.

Upgrade from LAN

To upgrade the Gateway's firmware from the LAN:

1. Download the Gateway's firmware upgrade file from www.linksys.com.
1. Extract the file on your computer.
1. Click the **Browse** button to find the firmware upgrade file.
2. Double-click the firmware file that you have downloaded and extracted.
3. Click the **Upgrade** button, and follow the on-screen instructions.

To cancel the firmware upgrade, click the **Cancel Upgrade** button.

Figure 5-48: Firmware Upgrade

The Reboot Tab

This screen allows you to do a soft or hard reboot of the Gateway. In most cases you should use the hard reboot. The soft reboot is similar to restarting your computer without physically powering down the computer.

Reboot

Reboot Mode. To reboot your Gateway, select **Hard** or **Soft**. Choose **Hard** to power cycle the Gateway or **Soft**. to restart it without a power cycle.

To begin the reboot process, click the **Save Settings** button. When a screen appears asking you if you really want to reboot the Gateway, click **OK**.

Click the **Cancel Changes** button if you want to cancel the reboot.

Figure 5-49: Reboot

The Status Tab

The Gateway Tab

This screen displays information about the Gateway and its Internet connection.

Gateway Information

This section displays the Gateway's Firmware Version, MAC Address, and (if an NTP server has been contacted) Current Time.

Internet Connection

This section shows the following information: the Connection, Login Type, Interface, IP Address, Subnet Mask, Default Gateway, DNS 1, 2, and 3 server IP addresses, and WINS address. Depending on the login type, other information about the connection may also appear.

Connect and **Disconnect** buttons appear when an ADSL connection is available. Use these buttons to bring the connection up or down.

Click the **Refresh** button if you want to refresh the displayed information.

Figure 5-50: Gateway

The Local Network Tab

The Local Network information that is displayed is the local Mac Address, IP Address, Subnet Mask, DHCP Server, Start IP Address, and End IP Address. To view the DHCP Clients Table, click the **DHCP Client Table** button. To view the ARP/RARP Table, click the **ARP/RARP Table** button.

DHCP Clients Table. The DHCP Active IP Table shows the current DHCP Client data. You will see the computer name, IP address, MAC address, and expiration time of the dynamic IP address for the wireless clients using the DHCP server. (This data is stored in temporary memory and changes periodically.) Click the **Refresh** button if you want to refresh the displayed information. To delete a client from the DHCP server, select the client, and then click the **Delete** button. Click the **Close** button to return to the *Local Network* screen.

ARP/RARP Table. The ARP/RARP Table shows the current data for the local network clients that have sent an ARP request to the Gateway. You will see their IP addresses and MAC addresses. (This data is stored in temporary memory and changes periodically.) An ARP request is a request sent by the Gateway asking clients with IP addresses for their MAC addresses, so the Gateway can map IP addresses to MAC addresses. RARP is the reverse of ARP. Click the **Refresh** button if you want to refresh the displayed information. Click the **Close** button to return to the *Local Network* screen.

Click the **Refresh** button if you want to refresh the displayed information.

Figure 5-51: Local Network

Figure 5-52: DHCP Active IP Table

Figure 5-53: ARP/RARP Table

The Wireless Tab

The Wireless network information that is displayed is the Wireless Firmware Version, MAC Address, Mode, SSID, DHCP Server, Channel, and Encryption Function.

Click the **Wireless Clients Connected** button to view a list of the wireless clients connected to the Gateway, along with their computer names, IP addresses, and MAC addresses. Click the **Refresh** button if you want to refresh the displayed information. Click the **Close** button to return to the *Wireless* screen.

Click the **Refresh** button if you want to refresh the displayed information.

Figure 5-54: Wireless

Figure 5-55: Networked Computers

The DSL Connection Tab

This screen shows information about the DSL connection and the PVC connection.

DSL Status

This section shows the following: DSL Status, DSL Modulation Mode, DSL Path Mode, Downstream Rate, Upstream Rate, Downstream Margin, Upstream Margin, Downstream Line Attenuation, Upstream Line Attenuation, Downstream Transmit Power, and Upstream Transmit Power.

PVC Connection

Connection: To view information about a particular PVC, select that PVC's number from this list.

This section displays the following information: Encapsulation, Multiplexing, QoS, Pcr Rate, Scr Rate, Autodetect, VPI, VCI, Enable status, and PVC Status.

Click the **Refresh** button if you want to refresh the displayed information.

Figure 5-56: DSL Connection

Appendix A: Troubleshooting

This appendix consists of two parts: "Common Problems and Solutions" and "Frequently Asked Questions." Provided are possible solutions to problems that may occur during the installation and operation of the Gateway. Read the descriptions below to help you solve your problems. If you can't find an answer here, check the Linksys international website at www.linksys.com/international.

Common Problems and Solutions

1. ***I need to set a static IP address on a computer.***

   You can assign a static IP address to a computer by performing the following steps:

   - For Windows 98 and Me:
     1. Click **Start**, **Settings**, and **Control Panel**. Double-click **Network**.
     2. In The following network components are installed box, select the TCP/IP-> associated with your Ethernet adapter. If you only have one Ethernet adapter installed, you will only see one TCP/IP line with no association to an Ethernet adapter. Highlight it and click the Properties button.
     3. In the TCP/IP properties window, select the IP address tab, and select Specify an IP address. Enter a unique IP address that is not used by any other computer on the network connected to the Gateway. Make sure that each IP address is unique for each computer or network device.
     4. Click the **Gateway** tab, and in the New Gateway prompt, enter 192.168.1.1, which is the default IP address of the Gateway. Click the Add button to accept the entry.
     5. Click the **DNS** tab, and make sure the DNS Enabled option is selected. Enter the Host and Domain names (e.g., John for Host and home for Domain). Enter the DNS entry provided by your ISP. If your ISP has not provided the DNS IP address, contact your ISP to get that information or go to its website for the information.
     6. Click the **OK** button in the TCP/IP properties window, and click Close or the OK button for the Network window.
     7. Restart the computer when asked.
   - For Windows 2000:
     1. Click **Start**, **Settings**, and **Control Panel**. Double-click **Network and Dial-Up Connections**.
     2. Right-click the Local Area Connection that is associated with the Ethernet adapter you are using, and select the Properties option.
     3. In the Components checked are used by this connection box, highlight Internet Protocol (TCP/IP), and click the **Properties** button. Select **Use the following IP address** option.
     4. Enter a unique IP address that is not used by any other computer on the network connected to the Gateway.
     5. Enter the Subnet Mask, 255.255.255.0.
     6. Enter the Default Gateway, 192.168.1.1 (Gateway's default IP address).

7. Toward the bottom of the window, select Use the following DNS server addresses, and enter the Preferred DNS server and Alternative DNS server (provided by your ISP). Contact your ISP or go on its website to find the information.
8. Click the **OK** button in the Internet Protocol (TCP/IP) Properties window, and click the **OK** button in the Local Area Connection Properties window.
9. Restart the computer if asked.

- For Windows XP:

The following instructions assume you are running Windows XP with the default interface. If you are using the Classic interface (where the icons and menus look like previous Windows versions), please follow the instructions for Windows 2000.

1. Click **Start** and **Control Panel**.
2. Click the **Network and Internet Connections** icon and then the **Network Connections** icon.
3. Right-click the **Local Area Connection** that is associated with the Ethernet adapter you are using, and select the Properties option.
4. In the **This connection uses the following items** box, highlight **Internet Protocol (TCP/IP)**. Click the **Properties** button.
5. Enter a unique IP address that is not used by any other computer on the network connected to the Gateway.
6. Enter the Subnet Mask, 255.255.255.0.
7. Enter the Default Gateway, 192.168.1.1 (Gateway's default IP address).
8. Toward the bottom of the window, select Use the following DNS server addresses, and enter the Preferred DNS server and Alternative DNS server (provided by your ISP). Contact your ISP or go on its website to find the information.
9. Click the **OK** button in the Internet Protocol (TCP/IP) Properties window. Click the **OK** button in the Local Area Connection Properties window.

2. I want to test my Internet connection.

A. Check your TCP/IP settings.

For Windows 98, Me, 2000, and XP:

- Refer to Windows Help for details. Make sure Obtain IP address automatically is selected in the settings.

For Windows NT 4.0:

- Click **Start**, **Setting**s, and **Control Panel**. Double-click the **Network** icon.
- Click the Protocol tab, and double-click on TCP/IP Protocol.
- When the window appears, make sure you have selected the correct Adapter for your Ethernet adapter and set it for **Obtain an IP address** from a DHCP server.
- Click the **OK** button in the TCP/IP Protocol Properties window, and click the **Close** button in the Network window.
- Restart the computer if asked.

B. Open a command prompt.

For Windows 98 and Me:

- Click **Start** and **Run**. In the Open field, type in command. Press the **Enter** key or click the **OK** button.

For Windows NT, 2000, and XP:

- Click **Start** and **Run**. In the Open field, type cmd. Press the **Enter** key or click the **OK** button. In the command prompt, type ping 192.168.1.1 and press the Enter key.
- If you get a reply, the computer is communicating with the Gateway.
- If you do NOT get a reply, please check the cable, and make sure Obtain an IP address automatically is selected in the TCP/IP settings for your Ethernet adapter.

C. In the command prompt, type ping followed by your Internet or WAN IP address and press the **Enter** key. The Internet or WAN IP Address can be found on the Status screen of the Gateway's web-based utility. For example, if your Internet or WAN IP address is 1.2.3.4, you would enter ping 1.2.3.4 and press the Enter key.

- If you get a reply, the computer is connected to the Gateway.
- If you do NOT get a reply, try the ping command from a different computer to verify that your original computer is not the cause of the problem.

D. In the command prompt, type ping www.yahoo.com and press the **Enter** key.

- If you get a reply, the computer is connected to the Internet. If you cannot open a webpage, try the ping command from a different computer to verify that your original computer is not the cause of the problem.
- If you do NOT get a reply, there may be a problem with the connection. Try the ping command from a different computer to verify that your original computer is not the cause of the problem.

3. I am not getting an IP address on the Internet with my Internet connection.

- Refer to "Problem #2, I want to test my Internet connection" to verify that you have connectivity.
  1. Make sure you are using the right Internet connection settings. Contact your ISP to see if your Internet connection type is RFC 1483 Bridged, RFC 1483 Routed, RFC 2516 PPPoE, or RFC 2364 PPPoA. Please refer to the Setup section of "Chapter 5: Configuring the Wireless-G ADSL Home Gateway" for details on Internet connection settings.
  2. Make sure you have the right cable. Check to see if the Gateway column has a solidly lit ADSL LED.
  3. Make sure the cable connecting from your Gateway's ADSL port is connected to the wall jack of the ADSL service line. Verify that the Status page of the Gateway's web-based utility shows a valid IP address from your ISP.
  4. Turn off the computer and Gateway. Wait 30 seconds, and then turn on the Gateway, and computer. Check the Status tab of the Gateway's web-based utility to see if you get an IP address.

4. I am not able to access the Setup page of the Gateway's web-based utility.

- Refer to "Problem #2, I want to test my Internet connection" to verify that your computer is properly connected to the Gateway.
  1. Refer to "Appendix C: Finding the MAC Address and IP address for Your Ethernet Adapter" to verify that your computer has an IP Address, Subnet Mask, Gateway, and DNS.
  2. Set a static IP address on your system; refer to "Problem #1: I need to set a static IP address."

3. Refer to "Problem #10: I am a PPPoE user, and I need to remove the proxy settings or the dial-up pop-up window."

5. I can't get my Virtual Private Network (VPN) working through the Gateway.

Access the Gateway's web interface by going to http://192.168.1.1 or the IP address of the Gateway, and go to the Security tab. Make sure you have IPsec passthrough and/or PPTP pass-through enabled.

- VPNs that use IPSec with the ESP (Encapsulation Security Payload known as protocol 50) authentication will work fine. At least one IPSec session will work through the Gateway; however, simultaneous IPSec sessions may be possible, depending on the specifics of your VPNs.
- VPNs that use IPSec and AH (Authentication Header known as protocol 51) are incompatible with the Gateway. AH has limitations due to occasional incompatibility with the NAT standard.
- Change the IP address for the Gateway to another subnet to avoid a conflict between the VPN IP address and your local IP address. For example, if your VPN server assigns an IP address 192.168.1.X (X is a number from 1 to 254) and your local LAN IP address is 192.168.1.X (X is the same number used in the VPN IP address), the Gateway will have difficulties routing information to the right location. If you change the Gateway's IP address to 192.168.2.1, that should solve the problem. Change the Gateway's IP address through the Setup tab of the web interface.
- If you assigned a static IP address to any computer or network device on the network, you need to change its IP address accordingly to 192.168.2.Y (Y being any number from 1 to 254). Note that each IP address must be unique within the network.
- Your VPN may require port 500/UDP packets to be passed to the computer that is connecting to the IPSec server. Refer to "Problem #7, I need to set up online game hosting or use other Internet applications" for details.
- Check the Linksys international website for more information at www.linksys.com/international.

6. I need to set up a server behind my Gateway and make it available to the public.

To use a server like a web, ftp, or mail server, you need to know the respective port numbers they are using. For example, port 80 (HTTP) is used for web; port 21 (FTP) is used for FTP, and port 25 (SMTP outgoing) and port 110 (POP3 incoming) are used for the mail server. You can get more information by viewing the documentation provided with the server you installed.

- Follow these steps to set up port forwarding through the Gateway's web-based utility. We will be setting up web, ftp, and mail servers.
  1. Access the Gateway's web-based utility by going to http://192.168.1.1 or the IP address of the Gateway. Go to the Applications and Gaming => Port Range Forwarding tab.
  2. Enter any name you want to use for the Customized Application.
  3. Enter the External Port range of the service you are using. For example, if you have a web server, you would enter the range 80 to 80.
  4. Check the protocol you will be using, TCP and/or UDP.
  5. Enter the IP address of the computer or network device that you want the port server to go to. For example, if the web server's Ethernet adapter IP address is 192.168.1.100, you would enter 100 in the

field provided. Check "Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter" for details on getting an IP address.

6. Check the Enable option for the port services you want to use. Consider the example below:

Customized Application	External Port	TCP	UDP	IP Address	Enable
Web server	80 to 80	X		192.168.1.100	X
FTP server	21 to 21	X		192.168.1.101	X
SMTP (outgoing)	25 to 25	X		192.168.1.102	X
POP3 (incoming)	110 to 110	X		192.168.1.102	X

When you have completed the configuration, click the **Save Settings** button.

7. I need to set up online game hosting or use other Internet applications.

If you want to play online games or use Internet applications, most will work without doing any port forwarding or DMZ hosting. There may be cases when you want to host an online game or Internet application. This would require you to set up the Gateway to deliver incoming packets or data to a specific computer. This also applies to the Internet applications you are using. The best way to get the information on what port services to use is to go to the website of the online game or application you want to use. Follow these steps to set up online game hosting or use a certain Internet application:

1. Access the Gateway's web interface by going to http://192.168.1.1 or the IP address of the Gateway. Go to the Applications and Gaming => Port Range Forwarding tab.
2. Enter any name you want to use for the Customized Application.
3. Enter the External Port range of the service you are using. For example, if you want to host Unreal Tournament (UT), you would enter the range 7777 to 27900.
4. Check the protocol you will be using, TCP and/or UDP.
5. Enter the IP address of the computer or network device that you want the port server to go to. For example, if the web server's Ethernet adapter IP address is 192.168.1.100, you would enter 100 in the field provided. Check "Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter" for details on getting an IP address.
6. Check the **Enable** option for the port services you want to use. Consider the example below:

Customized Application	External Port	TCP	UDP	IP Address	Enable
UT	7777 to 27900	X	X	192.168.1.100	X
Halflife	27015 to 27015	X	X	192.168.1.105	X
PC Anywhere	5631 to 5631		X	192.168.1.102	X
VPN IPSEC	500 to 500		X	192.168.1.100	X

When you have completed the configuration, click the **Save Settings** button.

8. I can't get the Internet game, server, or application to work.

If you are having difficulties getting any Internet game, server, or application to function properly, consider exposing one computer to the Internet using DeMilitarized Zone (DMZ) hosting. This option is available when an application requires too many ports or when you are not sure which port services to use. Make sure you disable all the forwarding entries if you want to successfully use DMZ hosting, since forwarding has priority over DMZ hosting. (In other words, data that enters the Gateway will be checked first by the forwarding settings. If the port number that the data enters from does not have port forwarding, then the Gateway will send the data to whichever computer or network device you set for DMZ hosting.)

- Follow these steps to set DMZ hosting:
  1. Access the Gateway's web-based utility by going to http://192.168.1.1 or the IP address of the Gateway. Go to the Applications and Gaming => DMZ tab. Click Enabled and enter the IP of the computer.
  2. Check the Port Forwarding pages and disable or remove the entries you have entered for forwarding. Keep this information in case you want to use it at a later time.
- Once completed with the configuration, click the **Save Settings** button.

9. I forgot my password, or the password prompt always appears when I am saving settings to the Gateway.

- Reset the Gateway to factory default by pressing the Reset button for 10 seconds and then releasing it. If you are still getting prompted for a password when saving settings, then perform the following steps:
  1. Access the Gateway's web-based utility by going to http://192.168.1.1 or the IP address of the Gateway. Enter the default username and password **admin**, and click the **Administrations** => **Management** tab.
  2. Enter a different password in the Gateway Password field, and enter the same password in the second field to confirm the password.
  3. Click the **Save Settings** button.

10. I am a PPPoE user, and I need to remove the proxy settings or the dial-up pop-up window.

If you have proxy settings, you need to disable these on your computer. Because the Gateway is the gateway for the Internet connection, the computer does not need any proxy settings to gain access. Please follow these directions to verify that you do not have any proxy settings and that the browser you use is set to connect directly to the LAN.

- For Microsoft Internet Explorer 5.0 or higher:
  1. Click **Start, Settings**, and **Control Panel**. Double-click Internet Options.
  2. Click the **Connections** tab.
  3. Click the **LAN settings** button and remove anything that is checked.
  4. Click the **OK** button to go back to the previous screen.
  5. Click the option **Never dial a connection**. This will remove any dial-up pop-ups for PPPoE users.

- For Netscape 4.7 or higher:
  1. Start **Netscape Navigator**, and click **Edit**, **Preferences**, **Advanced**, and **Proxies**.
  2. Make sure you have Direct connection to the Internet selected on this screen.
  3. Close all the windows to finish.

11. To start over, I need to set the Gateway to factory default.

Hold the **Reset** button for 10 seconds and then release it. This will return the Internet settings, password, forwarding, and other settings on the Gateway to the factory default settings. In other words, the Gateway will revert to its original factory configuration.

12. I need to upgrade the firmware.

In order to upgrade the firmware with the latest features, you need to go to the Linksys international website and download the latest firmware at www.linksys.com/international.

- Follow these steps:
  1. Go to the Linksys international website at http://www.linksys.com/international and select your region or country.
  2. Click the **Products** tab and select the Gateway.
  3. On the Gateway's webpage, click **Firmware**, and then download the latest firmware for the Gateway.
  4. To upgrade the firmware, follow the steps in the Administration section found in "Chapter 5: Configuring the Wireless-G ADSL Home Gateway."

13. The firmware upgrade failed, and/or the Power LED is flashing.

The upgrade could have failed for a number of reasons. Follow these steps to upgrade the firmware and/or make the Power LED stop flashing:

- If the firmware upgrade failed, use the TFTP program (it was downloaded along with the firmware). Open the pdf that was downloaded along with the firmware and TFTP program, and follow the pdf's instructions.
- Set a static IP address on the computer; refer to "Problem #1, I need to set a static IP address." Use the following IP address settings for the computer you are using:
  IP Address: 192.168.1.50
  Subnet Mask: 255.255.255.0
  Gateway: 192.168.1.1
- Perform the upgrade using the TFTP program or the Gateway's web-based utility through its Administration tab.

14. My DSL service's PPPoE is always disconnecting.

PPPoE is not actually a dedicated or always-on connection. The DSL ISP can disconnect the service after a period of inactivity, just like a normal phone dial-up connection to the Internet.

- There is a setup option to "keep alive" the connection. This may not always work, so you may need to re-establish connection periodically.

1. To connect to the Gateway, go to the web browser, and enter http://192.168.1.1 or the IP address of the Gateway.
2. Enter the username and password, if asked. (The default username and password is admin.)
3. On the Setup screen, select the option **Keep Alive**, and set the Redial Period option at 20 (seconds).
4. Click the **Save Settings** button. Click the **Status** tab, and click the **Connect** button.
5. You may see the login status display as Connecting. Press the F5 key to refresh the screen, until you see the login status display as Connected.
6. Click the **Save Settings** button to continue.

- If the connection is lost again, follow steps 1- 6 to re-establish connection.

15. I can't access my e-mail, web, or VPN, or I am getting corrupted data from the Internet.

The Maximum Transmission Unit (MTU) setting may need to be adjusted. By default, the MTU is set automatically.

- If you are having some difficulties, perform the following steps:
  1. To connect to the Gateway, go to the web browser, and enter http://192.168.1.1 or the IP address of the Gateway.
  2. Enter the username and password, if asked. (The default username and password is admin.)
  3. Look for the MTU option, and select **Manual**. In the Size field, enter 1492.
  4. Click the **Save Settings** button to continue.
- If your difficulties continue, change the Size to different values. Try this list of values, one value at a time, in this order, until your problem is solved:
  1462
  1400
  1362
  1300

16. The Power LED flashes continuously.

The Power LED lights up when the device is first powered up. In the meantime, the system will boot up itself and check for proper operation. After finishing the checking procedure, the LED remains steady to show that the system is working fine. If the LED continues to flash after this time, the device is not working properly. Try to flash the firmware by assigning a static IP address to the computer, and then upgrade the firmware. Try using the following settings, IP Address: 192.168.1.50 and Subnet Mask: 255.255.255.0.

17. When I enter a URL or IP address, I get a time-out error or am prompted to retry.

- Check if other computers work. If they do, ensure that your computer's IP settings are correct (IP Address, Subnet Mask, Default Gateway, and DNS). Restart the computer that is having a problem.
- If the computers are configured correctly, but still not working, check the Gateway. Ensure that it is connected and powered on. Connect to it and check its settings. (If you cannot connect to it, check the LAN and power connections.)

- If the Gateway is configured correctly, check your Internet connection (DSL/cable modem, etc.) to see if it is working correctly. You can remove the Gateway to verify a direct connection.
- Manually configure the TCP/IP settings with a DNS address provided by your ISP.
- Make sure that your browser is set to connect directly and that any dial-up is disabled. For Internet Explorer, click **Tools**, **Internet Options**, and then the **Connection** tab. Make sure that Internet Explorer is set to **Never dial a connection**. For Netscape Navigator, click **Edit**, **Preferences**, **Advanced**, and **Proxy**. Make sure that Netscape Navigator is set to **Direct connection to the Internet**.

18. I'm trying to access the Gateway's Web-based Utility, but I do not see the login screen. Instead, I see a screen saying, "404 Forbidden."

If you are using Windows Explorer, perform the following steps until you see the Web-based Utility's login screen (Netscape Navigator will require similar steps):

1. Click **File**. Make sure *Work Offline* is NOT checked.
2. Press **CTRL + F5**. This is a hard refresh, which will force Windows Explorer to load new webpages, not cached ones.

- Click **Tools**. Click **Internet Options**. Click the **Security** tab. Click the **Default level** button. Make sure the security level is Medium or lower. Then click the **OK** button.

Frequently Asked Questions

What is the maximum number of IP addresses that the Gateway will support?

The Gateway will support up to 253 IP addresses.

Is IPSec Passthrough supported by the Gateway?

Yes, it is a built-in feature that is enabled by default.

Where is the Gateway installed on the network?

In a typical environment, the Gateway is installed between the ADSL wall jack and the LAN.

Does the Gateway support IPX or AppleTalk?

No. TCP/IP is the only protocol standard for the Internet and has become the global standard for communications. IPX, a NetWare communications protocol used only to route messages from one node to another, and AppleTalk, a communications protocol used on Apple and Macintosh networks, can be used for LAN to LAN connections, but those protocols cannot connect from the Internet to a LAN.

Does the LAN connection of the Gateway support 100Mbps Ethernet?

The Gateway supports 100Mbps over the auto-sensing Fast Ethernet 10/100 switch on the LAN side of the Gateway.

What is Network Address Translation and what is it used for?
Network Address Translation (NAT) translates multiple IP addresses on the private LAN to one public address that is sent out to the Internet. This adds a level of security since the address of a computer connected to the private LAN is never transmitted on the Internet. Furthermore, NAT allows the Gateway to be used with low cost Internet accounts when only one TCP/IP address is provided by the ISP. The user may have many private addresses behind this single address provided by the ISP.

Does the Gateway support any operating system other than Windows 98SE, Windows Millennium, Windows 2000, or Windows XP?
Yes, but Linksys does not, at this time, provide technical support for setup, configuration or troubleshooting of any non-Windows operating systems.

Does the Gateway support ICQ send file?
Yes, with the following fix: click ICQ menu -> preference -> connections tab->, and check I am behind a firewall or proxy. Then set the firewall time-out to 80 seconds in the firewall setting. The Internet user can then send a file to a user behind the Gateway.

I set up an Unreal Tournament Server, but others on the LAN cannot join. What do I need to do?
If you have a dedicated Unreal Tournament server running, you need to create a static IP for each of the LAN computers and forward ports 7777, 7778, 7779, 7780, 7781, and 27900 to the IP address of the server. You can also use a port forwarding range of 7777 ~ 27900. If you want to use the UT Server Admin, forward another port. (Port 8080 usually works well but is used for remote admin. You may have to disable this.) Then in the [UWeb.WebServer] section of the server.ini file, set the ListenPort to 8080 (to match the mapped port above) and ServerName to the IP assigned to the Gateway from your ISP.

Can multiple gamers on the LAN get on one game server and play simultaneously with just one public IP address?
It depends on which network game or what kind of game server you are using. For example, Unreal Tournament supports multi-login with one public IP.

How do I get Half-Life: Team Fortress to work with the Gateway?
The default client port for Half-Life is 27005. The computers on your LAN need to have "+clientport 2700x" added to the HL shortcut command line; the x would be 6, 7, 8, and on up. This lets multiple computers connect to the same server. One problem: Version 1.0.1.6 won't let multiple computers with the same CD key connect at the same time, even if on the same LAN (not a problem with 1.0.1.3). As far as hosting games, the HL server does not need to be in the DMZ. Just forward port 27015 to the local IP address of the server computer.

The web page hangs; downloads are corrupt, or nothing but junk characters are being displayed on the screen. What do I need to do?

Force your Ethernet adapter to 10Mbps or half duplex mode, and turn off the "Auto-negotiate" feature of your Ethernet adapter as a temporary measure. (Please look at the Network Control Panel in your Ethernet adapter's Advanced Properties tab.) Make sure that your proxy setting is disabled in the browser. Check our website at www.linksys.com/international for more information.

If all else fails in the installation, what can I do?

Reset the Gateway by holding down the reset button until the Power LED fully turns on and off. Reset your DSL modem by powering the unit off and then on. Obtain and flash the latest firmware release that is readily available on the Linksys international website, www.linksys.com/international.

How will I be notified of new Gateway firmware upgrades?

All Linksys firmware upgrades are posted on the Linksys international website at www.linksys.com/international, where they can be downloaded for free. To upgrade the Gateway's firmware, use the Administration tab of the Gateway's web-based utility. If the Gateway's Internet connection is working well, there is no need to download a newer firmware version, unless that version contains new features that you would like to use.

Will the Gateway function in a Macintosh environment?

Yes, but the Gateway's setup pages are accessible only through Internet Explorer 4.0 or Netscape Navigator 4.0 or higher for Macintosh.

I am not able to get the web configuration screen for the Gateway. What can I do?

You may have to remove the proxy settings on your Internet browser, e.g., Netscape Navigator or Internet Explorer. Check with your browser documentation, and make sure that your browser is set to connect directly and that any dial-up is disabled. For Internet Explorer, click Tools, Internet Options, and then the Connection tab. Make sure that Internet Explorer is set to Never dial a connection. For Netscape Navigator, click Edit, Preferences, Advanced, and Proxy. Make sure that Netscape Navigator is set to Direct connection to the Internet.

What is DMZ Hosting?

Demilitarized Zone (DMZ) allows one IP address (computer) to be exposed to the Internet. Some applications require multiple TCP/IP ports to be open. It is recommended that you set your computer with a static IP if you want to use DMZ Hosting. To get the LAN IP address, see "Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter."

If DMZ Hosting is used, does the exposed user share the public IP with the Gateway?

No.

Does the Gateway pass PPTP packets or actively route PPTP sessions?

The Gateway allows PPTP packets to pass through.

Is the Gateway cross-platform compatible?
Any platform that supports Ethernet and TCP/IP is compatible with the Gateway.

How many ports can be simultaneously forwarded?
Theoretically, the Gateway can establish 520 sessions at the same time, but you can only forward 10 ranges of ports.

What are the advanced features of the Gateway?
The Gateway's advanced features include Advanced Wireless settings, Filters, Port Forwarding, Routing, and DDNS.

What is the maximum number of VPN sessions allowed by the Gateway?
The maximum number depends on many factors. At least one IPSec session will work through the Gateway; however, simultaneous IPSec sessions may be possible, depending on the specifics of your VPNs.

How can I check whether I have static or DHCP IP Addresses?
Consult your ISP to obtain this information.

How do I get mIRC to work with the Gateway?
Under the Port Forwarding tab, set port forwarding to 113 for the computer on which you are using mIRC.

Can the Gateway act as my DHCP server?
Yes. The Gateway has DHCP server software built-in.

Can I run an application from a remote computer over the wireless network?
This will depend on whether or not the application is designed to be used over a network. Consult the application's documentation to determine if it supports operation over a network.

What is the IEEE 802.11g standard?
It is one of the IEEE standards for wireless networks. The 802.11g standard allows wireless networking hardware from different manufacturers to communicate, provided that the hardware complies with the 802.11g standard. The 802.11g standard states a maximum data transfer rate of 54Mbps and an operating frequency of 2.4GHz.

What IEEE 802.11b and 802.11g features are supported?

The product supports the following IEEE 802.11b and IEEE 802.11g functions:

- CSMA/CA plus Acknowledge protocol
- Multi-Channel Roaming
- Automatic Rate Selection
- RTS/CTS feature
- Fragmentation
- Power Management

It also supports OFDM technology for 802.11g networking.

What is ad-hoc mode?

When a wireless network is set to ad-hoc mode, the wireless-equipped computers are configured to communicate directly with each other, peer-to-peer without the use of an access point.

What is infrastructure mode?

When a wireless network is set to infrastructure mode, the wireless network is configured to communicate with a network through a wireless access point.

What is roaming?

Roaming is the ability of a portable computer user to communicate continuously while moving freely throughout an area greater than that covered by a single access point. Before using the roaming function, the computer must make sure that it is the same channel number with the access point of dedicated coverage area.

To achieve true seamless connectivity, the wireless LAN must incorporate a number of different functions. Each node and access point, for example, must always acknowledge receipt of each message. Each node must maintain contact with the wireless network even when not actually transmitting data. Achieving these functions simultaneously requires a dynamic RF networking technology that links access points and nodes. In such a system, the user's end node undertakes a search for the best possible access to the system. First, it evaluates such factors as signal strength and quality, as well as the message load currently being carried by each access point and the distance of each access point to the wired backbone. Based on that information, the node next selects the right access point and registers its address. Communications between end node and host computer can then be transmitted up and down the backbone.

As the user moves on, the end node's RF transmitter regularly checks the system to determine whether it is in touch with the original access point or whether it should seek a new one. When a node no longer receives acknowledgment from its original access point, it undertakes a new search. Upon finding a new access point, it then re-registers, and the communication process continues.

What is the ISM band?

The FCC and their counterparts outside of the U.S. have set aside bandwidth for unlicensed use in the ISM (Industrial, Scientific and Medical) band. Spectrum in the vicinity of 2.4 GHz, in particular, is being made available worldwide. This presents a truly revolutionary opportunity to place convenient high-speed wireless capabilities in the hands of users around the globe.

What is Spread Spectrum?

Spread Spectrum technology is a wideband radio frequency technique developed by the military for use in reliable, secure, mission-critical communications systems. It is designed to trade off bandwidth efficiency for reliability, integrity, and security. In other words, more bandwidth is consumed than in the case of narrowband transmission, but the trade-off produces a signal that is, in effect, louder and thus easier to detect, provided that the receiver knows the parameters of the spread-spectrum signal being broadcast. If a receiver is not tuned to the right frequency, a spread-spectrum signal looks like background noise. There are two main alternatives, Direct Sequence Spread Spectrum (DSSS) and Frequency Hopping Spread Spectrum (FHSS).

What is DSSS? What is FHSS? And what are their differences?

Frequency-Hopping Spread-Spectrum (FHSS) uses a narrowband carrier that changes frequency in a pattern that is known to both transmitter and receiver. Properly synchronized, the net effect is to maintain a single logical channel. To an unintended receiver, FHSS appears to be short-duration impulse noise. Direct-Sequence Spread-Spectrum (DSSS) generates a redundant bit pattern for each bit to be transmitted. This bit pattern is called a chip (or chipping code). The longer the chip, the greater the probability that the original data can be recovered. Even if one or more bits in the chip are damaged during transmission, statistical techniques embedded in the radio can recover the original data without the need for retransmission. To an unintended receiver, DSSS appears as low power wideband noise and is rejected (ignored) by most narrowband receivers.

Will the information be intercepted while it is being transmitted through the air?

WLAN features two-fold protection in security. On the hardware side, as with Direct Sequence Spread Spectrum technology, it has the inherent security feature of scrambling. On the software side, WLAN offers the encryption function (WEP) to enhance security and access control.

What is WEP?

WEP is Wired Equivalent Privacy, a data privacy mechanism based on a 64-bit or 128-bit shared key algorithm, as described in the IEEE 802.11 standard.

What is a MAC Address?

The Media Access Control (MAC) address is a unique number assigned by the manufacturer to any Ethernet networking device, such as a network adapter, that allows the network to identify it at the hardware level. For all practical purposes, this number is usually permanent. Unlike IP addresses, which can change every time a computer logs onto the network, the MAC address of a device stays the same, making it a valuable identifier for the network.

How do I reset the Gateway?
Press the Reset button on the back panel for about ten seconds. This will reset the Gateway to its default settings.

How do I resolve issues with signal loss?
There is no way to know the exact range of your wireless network without testing. Every obstacle placed between the Gateway and a wireless computer will create signal loss. Lead glass, metal, concrete floors, water and walls will inhibit the signal and reduce range. Start with the Gateway and your wireless computer in the same room and move it away in small increments to determine the maximum range in your environment.

You may also try using different channels, as this may eliminate interference affecting only one channel.

I have excellent signal strength, but I cannot see my network.
WEP is probably enabled on the Gateway, but not on your wireless adapter (or vice versa). Verify that the same WEP keys and levels (64 or 128) are being used on all nodes of your wireless network.

How many channels/frequencies are available with the Gateway?
There are eleven available channels, ranging from 1 to 11, in North America. There may be additional channels available in other regions, subject to the regulations of your region and/or country.

If your questions are not addressed here, refer to the Linksys international website, www.linksys.com/international.

Appendix B: Wireless Security

Linksys wants to make wireless networking as safe and easy for you as possible. The current generation of Linksys products provide several network security features, but they require specific action on your part for implementation. So, keep the following in mind whenever you are setting up or using your wireless network.

Security Precautions

The following is a complete list of security precautions to take (at least steps 1 through 5 should be followed):

1. Change the default SSID.
2. Disable SSID Broadcast.
3. Change the default password for the Administrator account.
4. Enable MAC Address Filtering.
5. Change the SSID periodically.
6. Use the highest encryption algorithm possible. Use WPA if it is available. Please note that this may reduce your network performance.
7. Change the WEP encryption keys periodically.

For information on implementing these security features, refer to "Chapter 6: Configuring the Wireless-G ADSL Home Gateway."

NOTE: Some of these security features are available only through the network gateway, router, or access point. Refer to the gateway, router, or access point's documentation for more information.

Security Threats Facing Wireless Networks

Wireless networks are easy to find. Hackers know that in order to join a wireless network, wireless networking products first listen for "beacon messages". These messages can be easily decrypted and contain much of the network's information, such as the network's SSID (Service Set Identifier). Here are the steps you can take:

Change the administrator's password regularly. With every wireless networking device you use, keep in mind that network settings (SSID, WEP keys, etc.) are stored in its firmware. Your network administrator is the only person who can change network settings. If a hacker gets a hold of the administrator's password, he, too, can change those settings. So, make it harder for a hacker to get that information. Change the administrator's password regularly.

SSID. There are several things to keep in mind about the SSID:

1. Disable Broadcast
2. Make it unique
3. Change it often

Most wireless networking devices will give you the option of broadcasting the SSID. While this option may be more convenient, it allows anyone to log into your wireless network. This includes hackers. So, don't broadcast the SSID.

Wireless networking products come with a default SSID set by the factory. (The Linksys default SSID is "linksys".) Hackers know these defaults and can check these against your network. Change your SSID to something unique and not something related to your company or the networking products you use.

Change your SSID regularly so that any hackers who have gained access to your wireless network will have to start from the beginning in trying to break in.

MAC Addresses. Enable MAC Address filtering. MAC Address filtering will allow you to provide access to only those wireless nodes with certain MAC Addresses. This makes it harder for a hacker to access your network with a random MAC Address.

WEP Encryption. Wired Equivalent Privacy (WEP) is often looked upon as a cure-all for wireless security concerns. This is overstating WEP's ability. Again, this can only provide enough security to make a hacker's job more difficult.

There are several ways that WEP can be maximized:

1. Use the highest level of encryption possible
2. Use "Shared Key" authentication
3. Change your WEP key regularly

WPA. Wi-Fi Protected Access (WPA) is the newest and best available standard in Wi-Fi security. Two modes are available: Pre-Shared Key and RADIUS. Pre-Shared Key gives you a choice of two encryption methods: TKIP (Temporal Key Integrity Protocol), which utilizes a stronger encryption method and incorporates Message Integrity Code (MIC) to provide protection against hackers, and AES (Advanced Encryption System), which utilizes a symmetric 128-Bit block data encryption. RADIUS (Remote Authentication Dial-In User Service) utilizes a RADIUS server for authentication and the use of dynamic TKIP, AES, or WEP.

IMPORTANT: Always remember that each device in your wireless network MUST use the same encryption method and encryption key or your wireless network will not function properly.

WPA Pre-Shared Key. If you do not have a RADIUS server, Select the type of algorithm, TKIP or AES, enter a password in the Pre-Shared key field of 8-64 characters, and enter a Group Key Renewal period time between 0 and 99,999 seconds, which instructs the Gateway or other device how often it should change the encryption keys.

WPA RADIUS. WPA used in coordination with a RADIUS server. (This should only be used when a RADIUS server is connected to the Gateway or other device.) First, select the type of WPA algorithm, **TKIP** or **AES**. Enter the RADIUS server's IP Address and port number, along with a key shared between the device and the server. Last, enter a Group Key Renewal period, which instructs the device how often it should change the encryption keys.

RADIUS. WEP used in coordination with a RADIUS server. (This should only be used when a RADIUS server is connected to the Gateway or other device.) First, enter the RADIUS server's IP Address and port number, along with a key shared between the device and the server. Then, select a WEP key and a level of WEP encryption, and either generate a WEP key through the Passphrase or enter the WEP key manually.

Implementing encryption may have a negative impact on your network's performance, but if you are transmitting sensitive data over your network, encryption should be used.

These security recommendations should help keep your mind at ease while you are enjoying the most flexible and convenient technology Linksys has to offer.

Appendix C: Finding the MAC Address and IP Address for Your Ethernet Adapter

This section describes how to find the MAC address for your computer's Ethernet adapter so you can use the MAC filtering feature of the Gateway. You can also find the IP address of your computer's Ethernet adapter. This IP address is used for the Gateway's filtering, forwarding, and/or DMZ features. Follow the steps in this appendix to find the adapter's MAC or IP address in Windows 98, Me, 2000, or XP.

Windows 98 or Me Instructions

1. Click **Start** and **Run**. In the *Open* field, enter **winipcfg**. Then press the **Enter** key or the **OK** button.
2. When the *IP Configuration* screen appears, select the Ethernet adapter you have connected to the Gateway via a CAT 5 Ethernet network cable. See Figure C-1.
3. Write down the Adapter Address as shown on your computer screen (see Figure C-2). This is the MAC address for your Ethernet adapter and is shown in hexadecimal as a series of numbers and letters.

   The MAC address/Adapter Address is what you will use for MAC filtering. The example in Figure D-2 shows the Ethernet adapters's MAC address as 00-00-00-00-00-00. Your computer will show something different.

   The example in Figure C-2 shows the Ethernet adapter's IP address as 192.168.1.100. Your computer may show something different.

Note: The MAC address is also called the Adapter Address.

Figure C-1: IP Configuration Screen

Figure C-2: MAC Address/Adapter Address

Windows 2000 or XP Instructions

1. Click **Start** and **Run**. In the *Open* field, enter **cmd**. Press the **Enter** key or click the **OK** button.

Note: The MAC address is also called the Physical Address.

2. At the command prompt, enter **ipconfig /all**. Then press the **Enter** key.

3. Write down the Physical Address as shown on your computer screen (Figure C-3); it is the MAC address for your Ethernet adapter. This appears as a series of numbers and letters.

   The MAC address/Physical Address is what you will use for MAC filtering. The example in Figure C-3 shows the Ethernet adapters's MAC address as 00-00-00-00-00-00. Your computer will show something different.

   The example in Figure C-3 shows the Ethernet adapter's IP address as 192.168.1.100. Your computer may show something different.

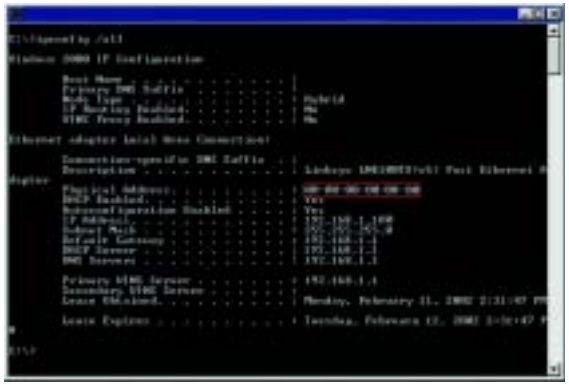

Figure C-3: MAC Address/Physical Address

Appendix D: Upgrading Firmware

To upgrade the Gateway's firmware:

1. Download the Gateway's firmware upgrade file from *www.linksys.com*.
2. Extract the file on your computer.
3. Open the Gateway's Web-based Utility and click the **Administration** tab.
4. Click the **Firmware Upgrade** tab.
5. Click the **Browse** button to find the extracted file, and then double-click it.
6. Click the **Upgrade** button, and follow the on-screen instructions.

Figure D-1: Firmware Upgrade

Appendix E: Glossary

802.11b - A wireless networking standard that specifies a maximum data transfer rate of 11Mbps and an operating frequency of 2.4GHz.

802.11g - A wireless networking standard that specifies a maximum data transfer rate of 54Mbps, an operating frequency of 2.4GHz, and backward compatibility with 802.11b devices.

Access Point - A device that allows wireless-equipped computers and other devices to communicate with a wired network. Also used to expand the range of a wireless network.

Adapter - A device that adds network functionality to your PC.

Ad-hoc - A group of wireless devices communicating directly with each other (peer-to-peer) without the use of an access point.

AES (**A**dvanced **E**ncryption **S**tandard) - A security method that uses symmetric 128-bit block data encryption.

Backbone - The part of a network that connects most of the systems and networks together, and handles the most data.

Bandwidth - The transmission capacity of a given device or network.

Beacon Interval - Data transmitted on your wireless network that keeps the network synchronized.

Bit - A binary digit.

Boot - To start a device and cause it to start executing instructions.

Bridge - A device that connects different networks.

Broadband - An always-on, fast Internet connection.

Browser - An application program that provides a way to look at and interact with all the information on the World Wide Web.

Buffer - A shared or assigned memory area that is used to support and coordinate different computing and networking activities so one isn't held up by the other.

Byte - A unit of data that is usually eight bits long

Cable Modem - A device that connects a computer to the cable television network, which in turn connects to the Internet.

CSMA/CA (**C**arrier **S**ense **M**ultiple **A**ccess/**C**ollision **A**voidance) - A method of data transfer that is used to prevent data collisions.

CTS (**C**lear **T**o **S**end) - A signal sent by a wireless device, signifying that it is ready to receive data.

Daisy Chain - A method used to connect devices in a series, one after the other.

Database - A collection of data that is organized so that its contents can easily be accessed, managed, and updated.

DDNS (**D**ynamic **D**omain **N**ame **S**ystem) - Allows the hosting of a website, FTP server, or e-mail server with a fixed domain name (e.g., www.xyz.com) and a dynamic IP address.

Default Gateway - A device that forwards Internet traffic from your local area network.

DHCP (**D**ynamic **H**ost **C**onfiguration **P**rotocol) - A networking protocol that allows administrators to assign temporary IP addresses to network computers by "leasing" an IP address to a user for a limited amount of time, instead of assigning permanent IP addresses.

DMZ (**Dem**ilitarized **Z**one) - Removes the Router's firewall protection from one PC, allowing it to be "seen" from the Internet.

DNS (**D**omain **N**ame **S**erver) - The IP address of your ISP's server, which translates the names of websites into IP addresses.

Domain - A specific name for a network of computers.

Download - To receive a file transmitted over a network.

DSL (**D**igital **S**ubscriber **L**ine) - An always-on broadband connection over traditional phone lines.

DSSS (**D**irect-**S**equence **S**pread-**S**pectrum) - Frequency transmission with a redundant bit pattern resulting in a lower probability of information being lost in transit.

DTIM (**D**elivery **T**raffic **I**ndication **M**essage) - A message included in data packets that can increase wireless efficiency.

Dynamic IP Address - A temporary IP address assigned by a DHCP server.

EAP (**E**xtensible **A**uthentication **P**rotocol) - A general authentication protocol used to control network access. Many specific authentication methods work within this framework.

EAP-PEAP (**E**xtensible **A**uthentication **P**rotocol-**P**rotected **E**xtensible **A**uthentication **P**rotocol) - A mutual authentication method that uses a combination of digital certificates and another system, such as passwords.

EAP-TLS (**E**xtensible **A**uthentication **P**rotocol-**T**ransport **L**ayer **S**ecurity) - A mutual authentication method that uses digital certificates.

Encryption - Encoding data transmitted in a network.

Ethernet - A networking protocol that specifies how data is placed on and retrieved from a common transmission medium.

Finger - A program that tells you the name associated with an e-mail address.

Firewall - A set of related programs located at a network gateway server that protects the resources of a network from users from other networks.

Firmware - The programming code that runs a networking device.

Fragmentation -Breaking a packet into smaller units when transmitting over a network medium that cannot support the original size of the packet.

FTP (**F**ile **T**ransfer **P**rotocol) - A protocol used to transfer files over a TCP/IP network.

Full Duplex - The ability of a networking device to receive and transmit data simultaneously.

Gateway - A device that interconnects networks with different, incompatible communications protocols.

Half Duplex - Data transmission that can occur in two directions over a single line, but only one direction at a time.

Hardware - The physical aspect of computers, telecommunications, and other information technology devices.

HTTP (**H**yper**T**ext **T**ransport **P**rotocol) - The communications protocol used to connect to servers on the World Wide Web.

Infrastructure - A wireless network that is bridged to a wired network via an access point.

IP (**I**nternet **P**rotocol) - A protocol used to send data over a network.

IP Address - The address used to identify a computer or device on a network.

IPCONFIG - A Windows 2000 and XP utility that displays the IP address for a particular networking device.

IPSec (**I**nternet **P**rotocol **Sec**urity) - A VPN protocol used to implement secure exchange of packets at the IP layer.

ISM band - Radio bandwidth utilized in wireless transmissions.

ISP (**I**nternet **S**ervice **P**rovider) - A company that provides access to the Internet.

LAN - The computers and networking products that make up your local network.

LEAP (**L**ightweight **E**xtensible **A**uthentication **P**rotocol) - A mutual authentication method that uses a username and password system.

MAC (**M**edia **A**ccess **C**ontrol) **Address** - The unique address that a manufacturer assigns to each networking device.

Mbps (**M**ega**B**its **P**er **S**econd) - One million bits per second; a unit of measurement for data transmission.

mIRC - An Internet Relay Chat program that runs under Windows.

Multicasting - Sending data to a group of destinations at once.

NAT (**N**etwork **A**ddress **T**ranslation) - NAT technology translates IP addresses of a local area network to a different IP address for the Internet.

Network - A series of computers or devices connected for the purpose of data sharing, storage, and/or transmission between users.

NNTP (**N**etwork **N**ews **T**ransfer **P**rotocol) - The protocol used to connect to Usenet groups on the Internet.

Node - A network junction or connection point, typically a computer or work station.

OFDM (**O**rthogonal **F**requency **D**ivision **M**ultiplexing) - Frequency transmission that separates the data stream into a number of lower-speed data streams, which are then transmitted in parallel to prevent information from being lost in transit.

Packet - A unit of data sent over a network.

Passphrase - Used much like a password, a passphrase simplifies the WEP encryption process by automatically generating the WEP encryption keys for Linksys products.

PEAP (**P**rotected **E**xtensible **A**uthentication **P**rotocol) - A mutual authentication method that uses a combination of digital certificates and another system, such as passwords.

Ping (**P**acket **IN**ternet **G**roper) - An Internet utility used to determine whether a particular IP address is online.

POP3 (**P**ost **O**ffice **P**rotocol **3**) - A standard mail server commonly used on the Internet.

Port - The connection point on a computer or networking device used for plugging in cables or adapters.

Power **o**ver **E**thernet (**PoE**) - A technology enabling an Ethernet network cable to deliver both data and power.

PPPoE (**P**oint to **P**oint **P**rotocol **o**ver **E**thernet) - A type of broadband connection that provides authentication (username and password) in addition to data transport.

PPTP (**P**oint-to-**P**oint **T**unneling **P**rotocol) - A VPN protocol that allows the Point to Point Protocol (PPP) to be tunneled through an IP network. This protocol is also used as a type of broadband connection in Europe.

Preamble - Part of the wireless signal that synchronizes network traffic.

PVC (**P**ermanent **V**irtual **C**ircuit) - A communication channel that provides the equivalent of a separate physical line.

QoS (**Q**uality **o**f **S**ervice) - Prioritization of network packets, mainly to ensure that time-sensitive data are delivered quickly.

RADIUS (**R**emote **A**uthentication **D**ial-**I**n **U**ser **S**ervice) - A protocol that uses an authentication server to control network access.

RJ-45 (**R**egistered **J**ack-**45**) - An Ethernet connector that holds up to eight wires.

Roaming - The ability to take a wireless device from one access point's range to another without losing the connection.

Router - A networking device that connects multiple networks together.

RTS (**R**equest **T**o **S**end) - A networking method of coordinating large packets through the RTS Threshold setting.

Server - Any computer whose function in a network is to provide user access to files, printing, communications, and other services.

SMTP (**S**imple **M**ail **T**ransfer **P**rotocol) - The standard e-mail protocol on the Internet.

SNMP (**S**imple **N**etwork **M**anagement **P**rotocol) - A widely used network monitoring and control protocol.

Software - Instructions for the computer. A series of instructions that performs a particular task is called a "program".

SOHO (**S**mall **O**ffice/**H**ome **O**ffice) - Market segment of professionals who work at home or in small offices.

SPI (**S**tateful **P**acket **I**nspection) **Firewall** - A technology that inspects incoming packets of information before allowing them to enter the network.

Spread Spectrum - Wideband radio frequency technique used for more reliable and secure data transmission.

SSID (**S**ervice **S**et **ID**entifier) - Your wireless network's name.

Static IP Address - A fixed address assigned to a computer or device that is connected to a network.

Static Routing - Forwarding data in a network via a fixed path.

Subnet Mask - An address code that determines the size of the network.

Switch - 1. A data switch that connects computing devices to host computers, allowing a large number of devices to share a limited number of ports. 2. A device for making, breaking, or changing the connections in an electrical circuit.

TCP (**T**ransmission **C**ontrol **P**rotocol) - A network protocol for transmitting data that requires acknowledgement from the recipient of data sent.

TCP/IP (**T**ransmission **C**ontrol **P**rotocol/**I**nternet **P**rotocol) - A set of instructions PCs use to communicate over a network.

Telnet - A user command and TCP/IP protocol used for accessing remote PCs.

TFTP (**T**rivial **F**ile **T**ransfer **P**rotocol) - A version of the TCP/IP FTP protocol that has no directory or password capability.

Throughput - The amount of data moved successfully from one node to another in a given time period.

TKIP (**T**emporal **K**ey **I**ntegrity **P**rotocol) - a wireless encryption protocol that provides dynamic encryption keys for each packet transmitted.

Topology - The physical layout of a network.

TX Rate - Transmission Rate.

UDP (**U**ser **D**atagram **P**rotocol) - A network protocol for transmitting data that does not require acknowledgement from the recipient of the data that is sent.

Upgrade - To replace existing software or firmware with a newer version.

Upload - To transmit a file over a network.

URL (**U**niform **R**esource **L**ocator) - The address of a file located on the Internet.

VPN (**V**irtual **P**rivate **N**etwork) - A security measure to protect data as it leaves one network and goes to another over the Internet.

WAN (**W**ide **A**rea **N**etwork)- The Internet.

WEP (**W**ired **E**quivalent **P**rivacy) - A method of encrypting network data transmitted on a wireless network for greater security.

WINIPCFG - A Windows 98 and Me utility that displays the IP address for a particular networking device.

WLAN (**W**ireless **L**ocal **A**rea **N**etwork) - A group of computers and associated devices that communicate with each other wirelessly.

WPA (**W**i-Fi **P**rotected **A**ccess) - a wireless security protocol using TKIP (Temporal Key Integrity Protocol) encryption, which can be used in conjunction with a RADIUS server.

Appendix F: Regulatory Information

FCC Statement

This product has been tested and complies with the specifications for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used according to the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which is found by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment or devices
- Connect the equipment to an outlet other than the receiver's
- Consult a dealer or an experienced radio/TV technician for assistance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

This transmitter must not be collocated or operating in conjunction with any other antenna or transmitter.
IEEE 802.11b or 802.11g operation of this product in the USA. is firmware-limited to channels 1 through 11.

Industry Canada (Canada)

Operation is subject to the following two conditions:
1) this device may not cause interference and
2) this device must accept any interference, including interference that may cause undesired operation of the device
This device has been designed to operate with an antenna having a maximum gain of 2dBi. Antenna having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is 50 ohms.
To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the EIRP is not more than required for successful communication.
IMPORTANT NOTE:
IC Radiation Exposure Statement:
This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.
This transmitter must not be collocated or operating in conjunction with any other antenna or transmitter.

Declaration dentistries Canada
Le fonctionnement est soumis aux conditions suivantes :
1.Ce peripherique ne doit pas causer d'interferences;
2.Ce peripherique doit accepter doit accepter toutes les interferences recues, y compris celles qui risquent d'entrainer un fonctionnement indesirable.

Compliance Information for 2.4-GHz Wireless Products Relevant to the EU and Other Countries Following the EU Directive 1999/5/EC (R&TTE Directive)

Declaration of Conformity with Regard to the EU Directive 1995/5/EC (R&TTE Directive)

Česky [Czech]:	Toto zařízení je v souladu se základními požadavky a ostatními odpovídajícími ustanoveními Směrnice 1999/5/EC.
Dansk [Danish]:	Dette udstyr er i overensstemmelse med de væsentlige krav og andre relevante bestemmelser i Direktiv 1999/5/EF.
Deutsch [German]:	Dieses Gerät entspricht den grundlegenden Anforderungen und den weiteren entsprechenden Vorgaben der Richtlinie 1999/5/EU.
Eesti [Estonian]:	See seade vastab direktiivi 1999/5/EÜ olulistele nõuetele ja teistele asjakohastele sätetele.
English:	This equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Español [Spanish]:	Este equipo cumple con los requisitos esenciales así como con otras disposiciones de la Directiva 1999/5/CE.
Ελληνική [Greek]:	Αυτός ο εξοπλισμός είναι σε συμμόρφωση με τις ουσιώδεις απαιτήσεις και άλλες σχετικές διατάξεις της Οδηγίας 1999/5/EC.
Français [French]:	Cet appareil est conforme aux exigences essentielles et aux autres dispositions pertinentes de la Directive 1999/5/EC.
Íslenska [Icelandic]:	Þetta tæki er samkvæmt grunnkröfum og öðrum viðeigandi ákvæðum Tilskipunar 1999/5/EC.
Italiano [Italian]:	Questo apparato è conforme ai requisiti essenziali ed agli altri principi sanciti dalla Direttiva 1999/5/CE.
Latviski [Latvian]:	Šī iekārta atbilst Direktīvas 1999/5/EK būtiskajām prasībām un citiem ar to saistītajiem noteikumiem.
Lietuvių [Lithuanian]:	Šis įrenginys tenkina 1999/5/EB Direktyvos esminius reikalavimus ir kitas šios direktyvos nuostatas.
Nederlands [Dutch]:	Dit apparaat voldoet aan de essentiele eisen en andere van toepassing zijnde bepalingen van de Richtlijn 1999/5/EC.
Malti [Maltese]:	Dan l-apparat huwa konformi mal-ħtiġiet essenzjali u l-provedimenti l-oħra rilevanti tad-Direttiva 1999/5/EC.
Magyar [Hungarian]:	Ez a készülék teljesíti az alapvető követelményeket és más 1999/5/EK irányelvben meghatározott vonatkozó rendelkezéseket.

Norsk [Norwegian]:	Dette utstyret er i samsvar med de grunnleggende krav og andre relevante bestemmelser i EU-direktiv 1999/5/EF.
Polski [Polish]:	Urządzenie jest zgodne z ogólnymi wymaganiami oraz szczególnymi warunkami określonymi Dyrektywą UE: 1999/5/EC.
Português [Portuguese]:	Este equipamento está em conformidade com os requisitos essenciais e outras provisões relevantes da Directiva 1999/5/EC.
Slovensko [Slovenian]:	Ta naprava je skladna z bistvenimi zahtevami in ostalimi relevantnimi pogoji Direktive 1999/5/EC.
Slovensky [Slovak]:	Toto zariadenie je v zhode so základnými požiadavkami a inými príslušnými nariadeniami direktív: 1999/5/EC.
Suomi [Finnish]:	Tämä laite täyttää direktiivin 1999/5/EY olennaiset vaatimukset ja on siinä asetettujen muiden laitetta koskevien määräysten mukainen.
Svenska [Swedish]:	Denna utrustning är i överensstämmelse med de väsentliga kraven och andra relevanta bestämmelser i Direktiv 1999/5/EC.

NOTE: If you need any technical documentation, see the "How to Access Technical Documents on www.linksys.com/international" section for more information.

The following standards were applied during the assessment of the product against the requirements of the Directive 1999/5/EC:

- Radio: EN 300 328
- EMC: EN 301 489-1, EN 301 489-17
- Safety: EN 60950

CE Marking

For the Linksys Wireless-B and Wireless-G products, the following CE mark, notified body number (where applicable), and class 2 identifier are added to the equipment.

CE 0560 ! or CE 0678 ! or CE !

Check the CE label on the product to find out which notified body was involved during the assessment.

National Restrictions

This product may be used in all EU countries (and other countries following the EU directive 1999/5/EC) without any limitation except for the countries mentioned below:

Ce produit peut être utilisé dans tous les pays de l'UE (et dans tous les pays ayant transposés la directive 1999/5/CE) sans aucune limitation, excepté pour les pays mentionnés ci-dessous:

Questo prodotto è utilizzabile in tutte i paesi EU (ed in tutti gli altri paesi che seguono le direttive EU 1999/5/EC) senza nessuna limitazione, eccetto per i paesii menzionati di seguito:

Das Produkt kann in allen EU Staaten ohne Einschränkungen eingesetzt werden (sowie in anderen Staaten die der EU Direktive 1995/5/CE folgen) mit Außnahme der folgenden aufgeführten Staaten:

Belgium

The Belgian Institute for Postal Services and Telecommunications (BIPT) must be notified of any outdoor wireless link having a range exceeding 300 meters. Please check http://www.bipt.be for more details.

Draadloze verbindingen voor buitengebruik en met een reikwijdte van meer dan 300 meter dienen aangemeld te worden bij het Belgisch Instituut voor postdiensten en telecommunicatie (BIPT). Zie http://www.bipt.be voor meer gegevens.

Les liaisons sans fil pour une utilisation en extérieur d'une distance supérieure à 300 mètres doivent être notifiées à l'Institut Belge des services Postaux et des Télécommunications (IBPT). Visitez http://www.ibpt.be pour de plus amples détails.

France

In case the product is used outdoors, the output power is restricted in some parts of the band. See Table 1 or check http://www.art-telecom.fr/ for more details.

Dans la cas d'une utilisation en extérieur, la puissance de sortie est limitée pour certaines parties de la bande. Reportez-vous à la table 1 ou visitez http://www.art-telecom.fr/ pour de plus amples détails.

Table 1: Applicable Power Levels in France

Location	Frequency Range (MHz)	Power (EIRP)
Indoor (No restrictions)	2400-2483.5	100 mW (20 dBm)
Outdoor	2400-2454 2454-2483.5	100 mW (20 dBm) 10 mW (10 dBm)

Italy

This product meets the National Radio Interface and the requirements specified in the National Frequency Allocation Table for Italy. Unless operating within the boundaries of the owner's property, the use of this 2.4 GHz Wireless LAN product requires a 'general authorization'. Please check with http://www.comunicazioni.it/it/ for more details.

Questo prodotto è conforme alla specifiche di Interfaccia Radio Nazionali e rispetta il Piano Nazionale di ripartizione delle frequenze in Italia. Se non viene installato all'interno del proprio fondo, l'utilizzo di prodotti Wireless LAN a 2.4 GHz richiede una "Autorizzazione Generale". Consultare http://www.comunicazioni.it/it/ per maggiori dettagli.

Product Usage Restrictions

This product is designed for indoor usage only. Outdoor usage is not recommended.

This product is designed for use with the included integral or external (dedicated) antenna(s). Use of non-dedicated or third-party antenna(s) is not recommended and is not supported by Linksys.

Power Output of Your Device

To comply with your country's regulations, you may have to change the power output of your wireless device. Proceed to the appropriate section for your device.

Note: The power output setting may not be available on all wireless products. For more information, refer to the documentation on your product's CD or at http://www.linksys.com/international.

Wireless Adapters

Wireless adapters have the power output set to 100% by default. Maximum power output on each adapter does not exceed 20 dBm (100 mW); it is generally 18 dBm (64 mW) or below. If you need to alter your wireless adapter's power output, follow the appropriate instructions for your computer's Windows operating system:

Windows XP
1. Double-click the **Wireless** icon in your desktop's system tray.
2. Open the *Wireless Network Connection* window.
3. Click the **Properties** button.
4. Select the **General** tab, and click the **Configure** button.
5. In the *Properties* window, click the **Advanced** tab.
6. Select **Power Output**.
7. From the pull-down menu on the right, select the wireless adapter's power output percentage.

Windows 2000
1. Open the **Control Panel**.
2. Double-click **Network and Dial-Up Connections**.
3. Select your current wireless connection, and select **Properties**.
4. From the *Properties* screen, click the **Configure** button.
5. Click the **Advanced** tab, and select **Power Output**.
6. From the pull-down menu on the right, select the wireless adapter's power setting.

If your computer is running Windows Millennium or 98, then refer to Windows Help for instructions on how to access the advanced settings of a network adapter.

Wireless Access Points, Routers, or Other Wireless Products

If you have a wireless access point, router or other wireless product, use its Web-based Utility to configure its power output setting (refer to the product's documentation for more information).

Technical Documents on www.linksys.com/international

Follow these steps to access technical documents:
1. Browse to http://www.linksys.com/international.
2. Click the region in which you reside.
3. Click the name of the country in which you reside.
4. Click **Products**.
5. Click the appropriate product category.
6. Select a product.
7. Click the type of documentation you want. The document will automatically open in PDF format.

Note: If you have questions regarding the compliance of these products or you cannot find the information you are looking for, please contact your local sales office. Visit http://www.linksys.com/international for more details.

Appendix G: Warranty Information

Linksys warrants to You that, for a period of three years (the "Warranty Period"), your Linksys Product will be substantially free of defects in materials and workmanship under normal use. Your exclusive remedy and Linksys' entire liability under this warranty will be for Linksys at its option to repair or replace the Product or refund Your purchase price less any rebates. This limited warranty extends only to the original purchaser.

If the Product proves defective during the Warranty Period call Linksys Technical Support in order to obtain a Return Authorization Number, if applicable. BE SURE TO HAVE YOUR PROOF OF PURCHASE ON HAND WHEN CALLING. If You are requested to return the Product, mark the Return Authorization Number clearly on the outside of the package and include a copy of your original proof of purchase. RETURN REQUESTS CANNOT BE PROCESSED WITHOUT PROOF OF PURCHASE. You are responsible for shipping defective Products to Linksys. Linksys pays for UPS Ground shipping from Linksys back to You only. Customers located outside of the United States of America and Canada are responsible for all shipping and handling charges.

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This warranty does not apply if the Product (a) has been altered, except by Linksys, (b) has not been installed, operated, repaired, or maintained in accordance with instructions supplied by Linksys, or (c) has been subjected to abnormal physical or electrical stress, misuse, negligence, or accident. In addition, due to the continual development of new techniques for intruding upon and attacking networks, Linksys does not warrant that the Product will be free of vulnerability to intrusion or attack.

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This Warranty is valid and may be processed only in the country of purchase.

Please direct all inquiries to: Linksys, P.O. Box 18558, Irvine, CA 92623.

Appendix H: Specifications

Model Number	WAG54G
Standards	IEEE 802.11g, 802.11b, 802.3u, 802.1p, 802.1Q; ITU G.992.1 (G.dmt), G.992.2 (G.lite), G.992.3, G.992.5; ANSI T1.413 Issue 2
Ports	Antenna, Power, ADSL, Ethernet (1-4)
Buttons	One power button and one reset button
Cabling Type	Category 5 UTP/STP, POTS phone cabling
LEDs	Power, Wireless, Ethernet (1-4), DSL, Internet
Transmit Power	18 dBm
UPnP able/cert	Able
Security Features	Password protected configuration for web access PAP and CHAP authentication Denial of Service (DoS) prevention URL and keyword filtering; Java, ActiveX, proxy, and cookie blocking ToD (Time of Day) filter VPN passthrough for IPSec, PPTP, and L2TP protocols IPSec VPN tunnel endpoint capability WPA PSK, WPA RADIUS, 128- and 64-bit WEP SSID Broadcast Disable Access restriction by MAC and IP addresses
WEP Key Bits	64, 128
Dimensions	140 mm x 140 mm x 27 mm (5.51" x 5.51" x 1.06")

Unit Weight	0.3 kg (0.6 lb.)
Power	12VDC 1A
Certifications	CE
Operating Temp.	0º~40ºC (32º~104ºF)
Storage Temp.	-20º~70ºC (-4º~158ºF)
Operating Humidity	10~85% Non-Condensing
Storage Humidity	5~90% Non-Condensing

Appendix I: Contact Information

Need to contact Linksys?
Visit us online for information on the latest products and updates to your existing products at:
http://www.linksys.com/international

If you experience problems with any Linksys product, you can e-mail us at:

In Europe	E-mail Address
Austria	support.at@linksys.com
Belgium	support.be@linksys.com
Denmark	support.dk@linksys.com
France	support.fr@linksys.com
Germany	support.de@linksys.com
Italy	support.it@linksys.com
Netherlands	support.nl@linksys.com
Norway	support.no@linksys.com
Portugal	support.pt@linksys.com
Spain	support.es@linksys.com
Sweden	support.se@linksys.com
Switzerland	support.ch@linksys.com
United Kingdom & Ireland	support.uk@linksys.com

Outside of Europe	E-mail Address
Latin America	support.la@linksys.com
U.S. and Canada	support@linksys.com